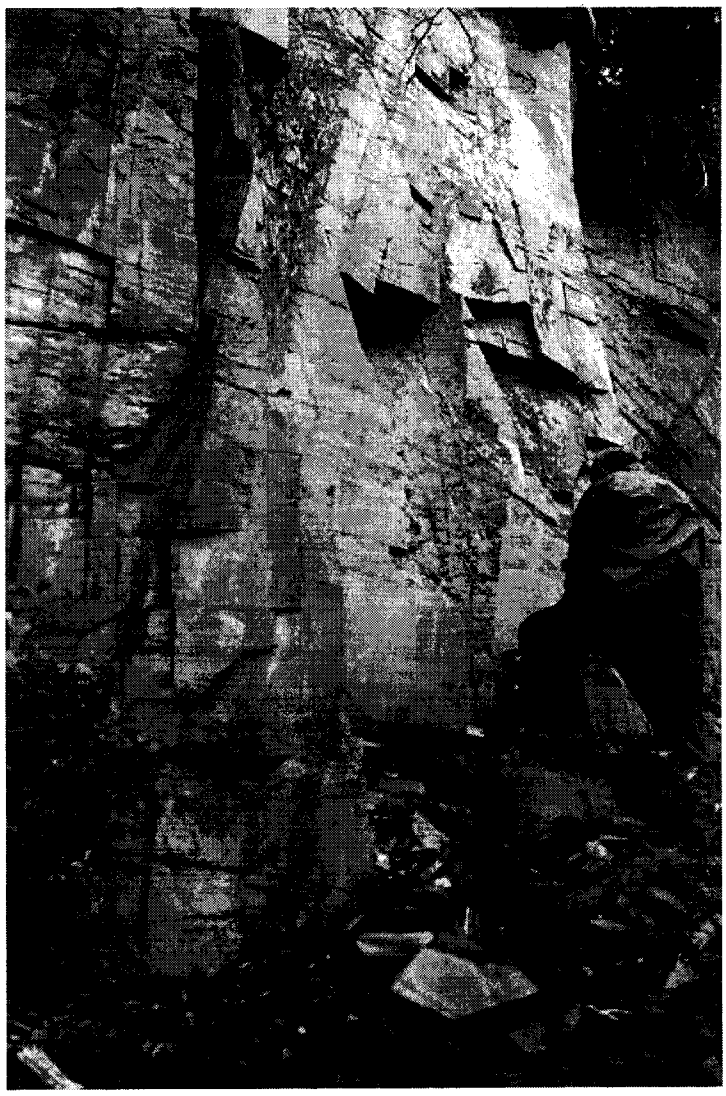
MINERAL MATERIALS SURVEY of the SEWARD and GLACIER RANGER DISTRICTS ROAD CORRIDOR, CHUGACH NATIONAL FOREST, ALASKA.

Volume I: Summary and Site Descriptions

by Gary E. Sherman, Earle M. Williams, and Mark P. Meyer



Bureau of Land Management

Alaska State Office
May 1997

MINERAL MATERIALS SURVEY of the SEWARD and GLACIER RANGER DISTRICTS ROAD CORRIDOR, CHUGACH NATIONAL FOREST, ALASKA.

Volume I: Summary and Site Descriptions

by Gary E. Sherman, Earle M. Williams, and Mark P. Meyer

This report was prepared under Interagency Agreement **95IA-10-04-013** between the USDI Bureau of Mines (USBM), Alaska Field Operations Center and the Forest Service, Chugach National Forest, USDA.

Upon closure of the Bureau of Mines in early 1996, the Bureau of Land Management (BLM) assumed the responsiblity for the USBM role in the agreement. Field work and report preparation were carried out under the auspices of BLM.

This is an unpublished report for use by the Forest Service and has not been reviewed for conformance to BLM editorial standards.

Table of Contents

Illustrations

Tables

Unit of Measure Abbreviations

dB	decibels
ft	feet
GIS	Geographic information system
GPR	Ground penetrating radar
GPS	Global positioning system
Hz	Hertz
in	inches
lbs	pounds
m	meter
mi	miles
MHz	megahertz
mm	millimeter
mt	metric tons

MINERAL MATERIALS SURVEY of the SEWARD and GLACIER RANGER DISTRICTS ROAD CORRIDOR, CHUGACH NATIONAL FOREST, ALASKA.

Volume I: Summary and Site Descriptions

by Gary E. Sherman[1], Earle M. Williams[2], and Mark P. Meyer[3].

Abstract

In 1995, the U.S. Bureau of Mines and the U.S.D.A. Forest Service, Alaska Region, Chugach National Forest entered into an three year Interagency Agreement to survey mineral materials on the Forest. Following closure of the Bureau of Mines and transfer of Alaska personnel in 1996, the work proceeded under the auspices of the Bureau of Land Management. Field work was conducted in 1996 with 27 sites being examined and 67 sand and gravel and rock samples taken. Ground penetrating radar surveys were conducted at twelve sites to determine depths to the water table and/or bedrock.

Results of the study indicate that common variety mineral materials of high quality are not abundant on the Forest. Twenty percent of the sand and gravel samples tested are suitable for use in asphalt, whereas none of the samples were found to meet the criteria for base course. All of the rock samples taken met the criteria for asphalt and 60% met the criteria for base course.

There are significant resources remaining on Forest land, especially if the material is to be used as borrow or fill. To properly exploit these resources, a pit management program is needed.

[1]Mining Engineer, BLM Alaska
[2]Mining Engineer, BLM Alaska
[3]Geologist, BLM Alaska

INTRODUCTION

In 1995, the U.S.D.A. Forest Service (USFS) and the U.S. Bureau of Mines (USBM) entered into a three year interagency agreement to conduct a survey of the mineral materials located within the Chugach National Forest, Alaska (CNF). USBM Alaska personnel and the interagency agreement were transferred to the U.S. Bureau of Land Management, Alaska State Office, Division of Resources (BLM) during early 1996. The field work for the project was conducted by BLM in 1996. The intent of the project was to determine the location, accessibility, quantity, and quality of mineral material sources. Sources of materials for aggregate, shot-rock, riprap, and other common varieties used in the construction industry were the main focus. Additional materials of interest included granite and granodiorite, limestone, marl, building stone, and slates.

Two major areas of interest were identified early on during the preliminary literature search: the Kenai Peninsula study area and the Cordova study area. These areas are located along existing transportation systems and are the areas identified with major ongoing and proposed road construction activities. Field work in 1996 was limited to the road corridor of the Seward and Glacier Districts on the Kenai Peninsula.

This survey included a review of literature and other sources of available information, identification of significant targets for field investigations, mapping and sampling those identified field sites, and ground penetrating radar (GPR) geophysics on selected sites.

LAND STATUS

Lands located within the CNF jurisdictional boundary include lands owned or managed by the State of Alaska, Alaska Native corporations (Chugach Alaska Corp. and Cook Inlet Region, Inc.) and villages (Chenega and Tatitlik), municipality lands, private inholdings, the Alaska Railroad Corporation (ARC), and State of Alaska Department of Transportation and Public Facilities (ADOT) transportation corridors. Lands abutting the western boundary of the CNF include those of the Kenai National Wildlife Refuge, the Kenai Fjords National Park, and the Chugach State Park. Those abutting the western boundary include the Wrangell - Saint Elias National Park and Preserve and Bureau of Land Management lands. Additional State of Alaska lands occur along the northern boundary of the forest.

ACKNOWLEDGMENTS

The authors would like to thank John E. Fritz, Chief Geologist, and Dan R. Pavey, Engineering Geologist, with the ADOT for all their help identifying needs to satisfy the road construction projects along the Seward and Sterling Highways and the Hope Road. We would also like to thank Cliff Fox and Donna Peterson of the USFS for sharing their knowledge of Forest resources, and Carol Huber with the USFS for her assistance in both the field work and input to this report.

CONSUMPTION AND USAGE OF MINERAL MATERIALS

Industrial mineral production for the southcentral region of Alaska during 1995 totaled approximately 4.2 million tons (3.9 million metric tons) of sand and gravel worth an estimated $11 million (Bundtzen, et. al., 1996). These resources were used for major road construction projects in the Anchorage and Valdez areas and major building projects in the Anchorage bowl area. The USFS sold 1,500 tons of blend sand from the pit at mile 28 of the Copper River Highway to a local contractor for use in road construction.

In November 1995, the ADOT released a Draft 1995 Needs List of the "Transportation Needs and Priorities in Alaska". Those projects which may have an affect on the CNF include highway and road construction activities, proposed trails and recreation access projects, ports and harbor projects, and other transportation activities. The major projects include the replacement of the Canyon Creek bridge, alignment/resurfacing sections of the Sterling and Seward Highways, the Cooper Landing bypass, and the Whittier highway access.

PREVIOUS STUDIES

During the early 1980's the USBM published a series of reports in conjunction with the USFS Roadless Area Review and Evaluation II (RARE II) study. No specific work was done on industrial minerals during this study; however, aggregate resources were identified as a result of the placer mine investigations (Jansons, 1984). At the same time the USGS was conducting Alaska Mineral Resources Appraisal Program (AMRAP) studies of the region which included geologic mapping (Nelson, 1985) and identification of alluvial sources for aggregates as part of a mineral resource potential study of the CNF (Nelson, 1984).

The ADOT has identified, mapped, and sampled numerous material sites within the CNF along the highway corridor for use in road construction projects. Material sites have also been identified by the ARC. The USFS has conducted studies on their "community pits" which have been set aside to meet the needs of the local communities.

PRESENT STUDY

The two study areas of interest (Kenai Peninsula study area and the Cordova study area) are located along the existing transportation corridors within the CNF. The acreage identified for field investigation included 612,718 acres in the Kenai Peninsula study area and 183,858 acres in the Cordova study area. Scattered granitic and granodiorite intrusives were also identified in the Prince William Sound and Cordova areas.

A preliminary literature search and identification phase of existing material sites used by the ADOT, ARC, and the USFS was conducted during 1996. Aerial photographs were used to aide in the identification of existing sites, mine tailing piles, and potential stream and bench gravel sources.

During 1996, the BLM conducted a 40 day field season mapping and sampling 27 material sites and gravel deposits located in the Kenai Peninsula area (see Figure 1). To identify potential new material sources, "grass roots" exploration was conducted in areas with no previous mining or gravel extraction. Work was restricted to the areas along the existing roads, highways, and trail systems. The main areas of interest were the area along the Sterling Highway near Cooper Landing and the Seward Highway along Canyon Creek, Quartz Creek, and the Moose Pass area. A total of 67 samples were collected. Ground penetrating radar (GPR) geophysics tests were performed at 12 sites to aide in the determination of depth to the water table and/or bedrock. Results of the GPR survey are presented in a companion report entitled *Volume II: Application of Ground Penetrating Radar to Site Delineation and Reserve Estimation.*

Sampling

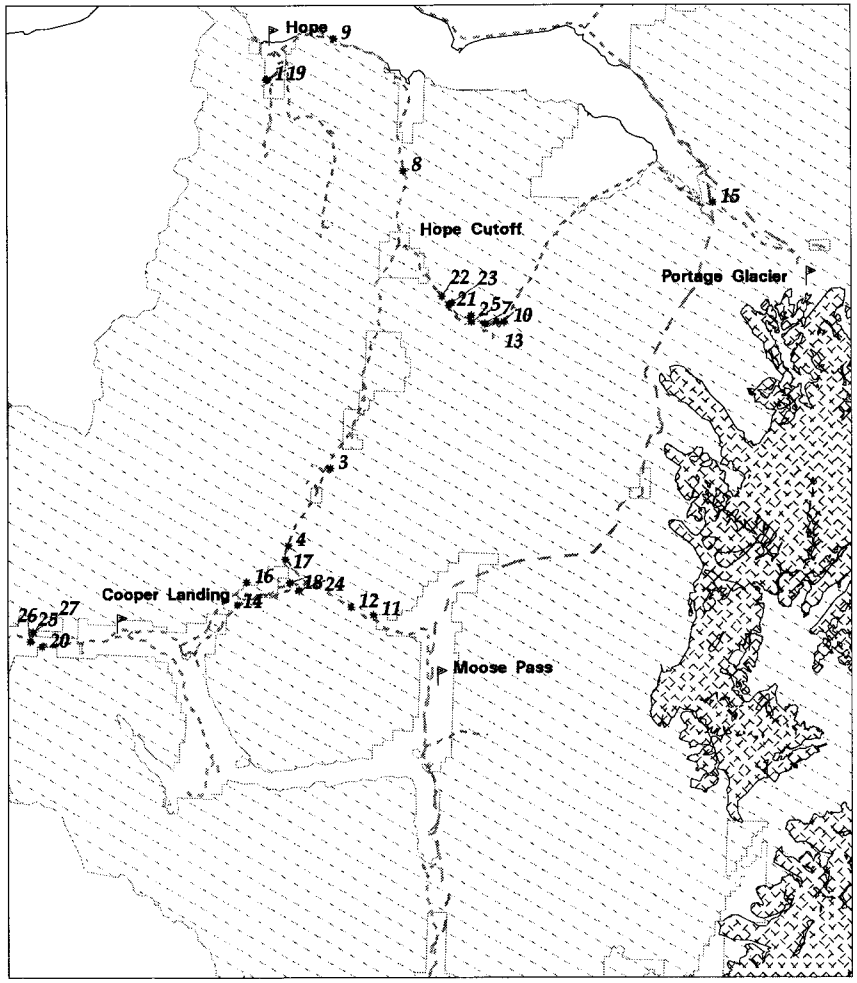
Sample sites were identified from literature search information, historical mining activity, aerial photography interpretation, and field reconnaissance. Existing material sites with little data were sampled to identify additional reserves. Valleys identified as having deposits of stream and bench gravels were identified for sampling. Hard rock mine tailings and waste dumps were also looked at for possible material sources.

At each sand and gravel sample site, vegetation and overburden was removed where necessary and approximately 700 lbs of material was collected by hand-excavating a sample hole or trench. Samples of sand and gravel were collected as either grab or screened. A grab sample consisted of at least 70 lbs of unclassified material collected for sieve analysis. A screened sample was run through a screening device that classified the material as +6", +3" to -6", and -3". The -3" fraction was quartered, split, and at least 70 lbs were retained. The oversize was weighed and discarded. The sample site was filled in and raked over with surrounding material to return the site to its original configuration.

CHUGACH NATIONAL FOREST MINERAL MATERIALS SURVEY

SITE LOCATIONS - 1996 FIELD WORK

May 1997



1 American Way Pit
2 Bear Pit
3 Canyon Creek Headwaters
4 Devils Creek Trailhead
5 East Fork Pit
6 Exit Glacier Road (not shown)
7 Fly Pit
8 Hope Mile 4
9 Hope Mile 13
10 Johnson Pass Trailhead Road
11 Mile 33-Sand Pit
12 Mile 35 Pit
13 North Granite Creek
14 Old Sterling Highway
15 Portage Valley
16 Quartz Creek Powerline
17 Quartz Creek Road
18 RS&S Quarry
19 Resurrection Creek Bench
20 Russian River Pit
21 Silvertip Pit
22 Silvertip Creek Quarry
23 Silvertip Road
24 Tern Lake Fan
25 West Juneau Creek Pit
26 West Juneau Creek Road
27 West Juneau Creek Road Rock Source

CNF
Ice field
Roads
Rail
Sites Examined

N

Scale: Miles
0 5 10

*Land status from USFS 1993.

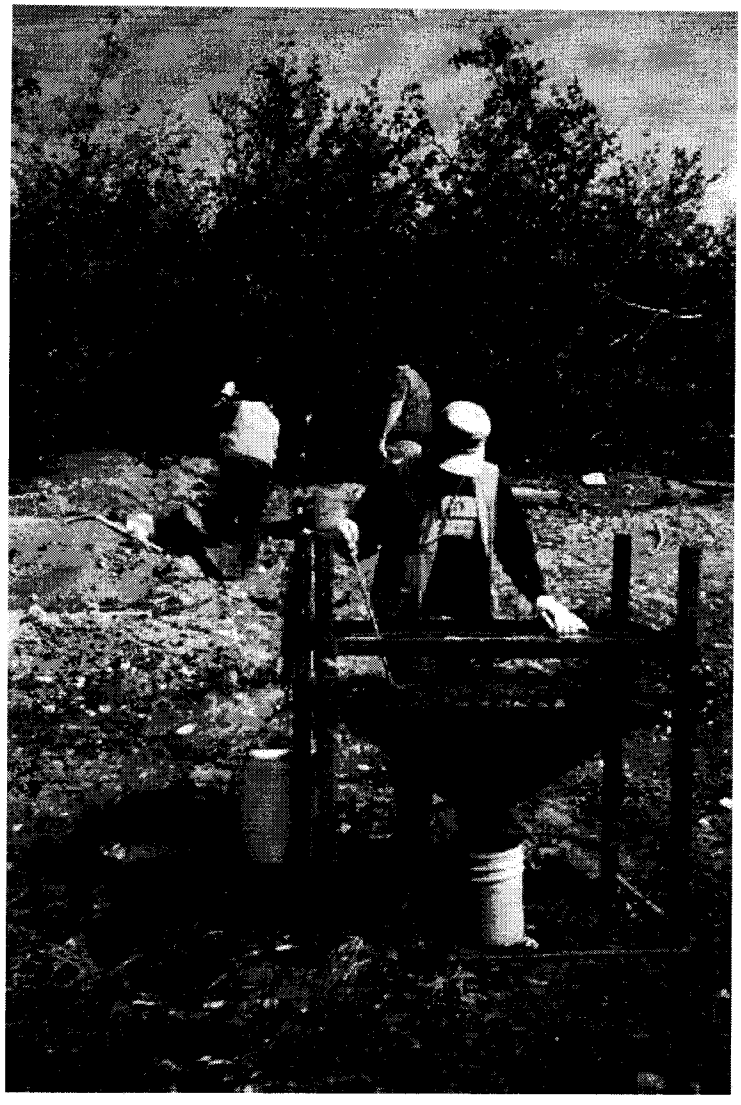


Figure 2. - Using the screening device to sample gravels on the West Juneau Creek Road.

Testing Procedures

Tests conducted on sand and gravel samples were based on standard testing procedures outlined by the American Association of State Highway and Transportation Officials (AASHTO), the American Society for Testing and Materials (ASTM), or ADOT. Those tests include:

1. AASHTO 27, sieve analysis for both coarse (> 0.185 in. or 4 mesh) and fine (< 0.185 in.) aggregates to determine size characteristics.

2. AASHTO T-96 or ATM-7, abrasion of coarse aggregate by the Los Angeles Machine to determine strength and wear characteristics (known as the L.A. abrasion test).

3. AASHTO T-104, soundness of both fine and coarse fractions of aggregates by use of sodium sulfate to determine strength and susceptibility from frost damage due to expansion of absorbed water.

4. Alaska Test Method ATM T-13[4] , degradation value of aggregates to determine the relative resistance of an aggregate to produce detrimental clay-like fines when subjected to a prescribed abrasion process

[4]Laboratory Manual of Alaska Test Methods and Standard Practices, DOT

in the presence of distilled or demineralized water.

Analytical testing of the samples collected during 1996 included sieve analysis, which was run on every sand and gravel sample, along with L.A. abrasion (T-96), Degradation (T-13), and Sulfate soundness (T-104) analyses run on selected samples. The analytical results are listed in Appendix B.

Pebble counts to determine rock type and visual lithology estimates were conducted at each sand and gravel sample site. Geophysical GPR studies were performed at those sites estimated to contain marketable quantities of aggregate.

Material Requirements

Aggregate

To be considered for use as aggregate for base or asphalt, a material must meet several criteria. These standard specifications for material quality use in Alaska are found in the ADOT handbook entitled *Standard Specifications for Highway Construction, 1988* (ADOT, 1988).

To determine the suitability of aggregate material, the T-96 (L.A. Abrasion) and T-13 (degradation) tests were primarily used as make or break determinations. Several samples were tested for sulfate soundness (T-104) and the results were well below the maximum allowed. It is presumed that this pattern holds true for the rock types found throughout the study area.

Requirements for crushed aggregate, whether from sand and gravel or rock are listed in Table 1.

Table 1. - Requirements for aggregate use in Alaska

Use	Test	Test number	Requirement
Aggregate for untreated base	Percent of wear	AASHTO T-96	50 max.
	Degradation value	ATM T-13	45 min.
	Percent fracture	ATM T-4	70 min.
Aggregate for asphalt pavement	Percent of wear	AASHTO T-96	45 max.
	Degradation value	ATM T-13	30 min.
	Sulfate soundness	AASHTO T-104	9 max
	Percent fracture	ATM T-4	70 min.

Riprap

Riprap is divided into four classes based on the size and weight of the stones. Riprap should have an L.A. Abrasion value (T-96) of not more than 50; all of the rock samples tested in the study met this requirement. In addition to the T-96 requirement, the least dimension of any stone shall not be less than 1/4 its greatest dimension (ADOT, 1988, p. 305). Some of the rock sources examined in the study were deemed unsuitable for riprap because they did not meet the length to width ratio restrictions.

Ground Penetrating Radar Study

A geophysical survey using ground penetrating radar (GPR) was conducted at twelve sites. The GPR technique provides rapid imaging of the subsurface to show depth to groundwater and/or depth to bedrock. Some of the benefits of using GPR include:

1. the ability to quickly map the subsurface along a profile across a gravel site,
2. a non-invasive method to measure gravel deposit thicknesses, and
3. a low-cost alternative to trenching using heavy equipment.

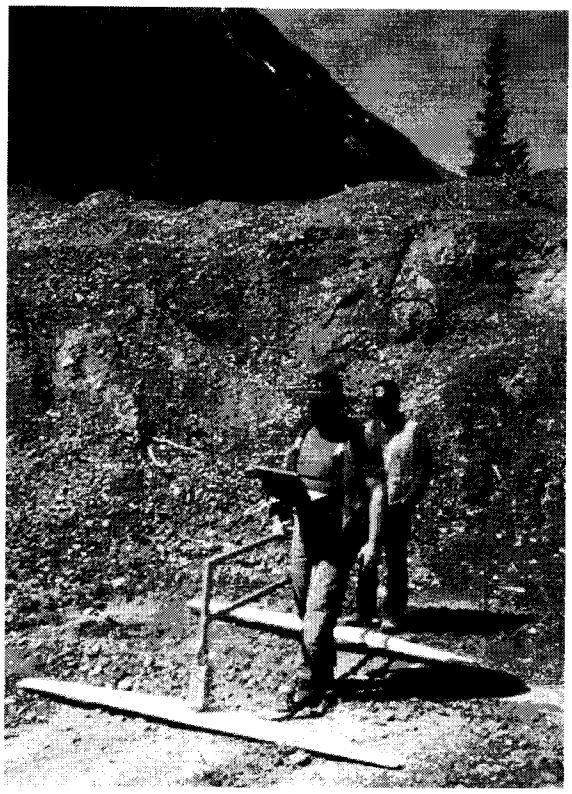


Figure 3. -Starting a 50MHz GPR line at the Mile 33 Sand Pit

Table 2 summarizes the GPR surveys. Walkaway tests were performed at several sites to determine the velocity of the electromagnetic wave through the material. Results from the GPR surveys are detailed in Volume II of this report.

Table 2. - GPR Survey Summary

Site	Number of lines	Antenna (MHz)	Walkaway
2 - Bear Pit	4	100	
5 - East Fork Pit	2	100	
7 - Fly Pit	3	100	
11- Mile 33 Sand Pit	2	200	
	4	50	
12 - Mile 35 Pit	5	50	
	1	50	x
15 - Portage Valley (Williwaw Campground Pond)	1	100	
	1	100	x
17 - Quartz Creek Road	2	100	
18 - RS & S Quarry	1	200	
20 - Russian River Pit	5	50	
	1	50	x
24 - Tern Lake Fan	3	200	
	5	50	
	1	200	x
25 - West Juneau Creek Pit	3	50	
	1	50	x
27 - West Juneau Creek Road Rock Source	1	50	

RESULTS

Based on data collected during the 1996 survey, the following general statements can be made regarding mineral materials on the Kenai Peninsula portion of the Chugach National Forest:

- The majority of existing pits have been depleted or can not be further expanded due to visual impacts or potential conflicts with other uses.
- The quality of the mineral material (with respect to use as aggregate for base or asphalt) available in the CNF is low. Only 20% of the sand and gravel samples tested met the criteria for use as asphalt. None of the samples met the criteria for use as base course.
- Of the rock sources examined and tested, all are suitable for use as crushed aggregate for pavement and 60% met the criteria for base course.
- The shallow water table in many areas requires excavating a large surface area to obtain significant quantities of material. An example of this is the East Fork Pit.
- Potential exists for expansion of several of the existing pits, including the Mile 35 and Russian River pits.
- New localities hold potential for future development, particularly if the intended use of the material is for borrow.
- A pit management program is needed to promote orderly extraction of materials and prevent the use of pits as dump sites for brush, asphalt, waste rock, etc. as noted in several existing pits.

RECOMMENDATIONS

Some localities on the Kenai Peninsula portion of the CNF warrant further examination. These areas include:

- Quartz Creek Road as a source of sand
- Canyon Creek Headwaters deposit
- Quartz Creek powerline/road
- Portage Valley
- Benches along East Fork from the Silvertip Pit to the confluence of Bench and Center Creeks

To properly evaluate the most promising sites, small sample trenches are required to examine the nature of the deposit beyond the depths excavated by hand methods.

Of primary importance is the establishment of a pit management program to efficiently manage the limited mineral material resources currently available on the CNF.

BIBLIOGRAPHY

Alaska Department of Transportation and Public Facilities. Standard Specifications for Highway Construction. 1988, pp. 519-530.

Alaska Department of Transportation and Public Facilities. Draft - Transportation Needs and Priorities in Alaska. November, 1995, 282 pp.

Bundtzen, T.K., R.C. Swainbank, A.H. Clough, M.W. Henning, and K.M. Charlie. Alaska's Mineral Industry 1995. State of Alaska Div. Geol. and Geophys. Surv. Spec Rep. 50, 1996, p. 32.

Clark, S.H.B. Reconnaissance Bedrock Geologic Map of the Chugach Mountains Near Anchorage, Alaska. U.S. Geol. Surv. Misc. Field Studies Map MF-350, 1972.

Cobb, E.H., and R.G. Tysdal. Summaries of Data on and lists of References to Metallic and Selected Nonmetallic Mineral Deposits in the Blying Sound and Seward Quadrangles, Alaska. U.S. Geol. Surv. OFR 80-621, 1980, p. 140.

Eckhart, R.C., and G. Plafker. Haydite Raw Material in the Kings River, Sutton, and Lawing Areas, Alaska. U.S. Geol. Surv. Bull. 1039-C, 1959, pp. 45-63.

Herreid, G. Russian River Travertine (Good Luck Mine) Limestone. AK. Territorial Dept. of Mines, PE-95-22, 1967, 6 pp.

Jansons, U., R.B. Hoekzema, J.M. Kurtak, and S.A. Fechner. Mineral Occurrences in the Chugach National Forest, Southcentral Alaska. BuMines MLA 5-84, 1984, 218 pp.

Le Compte, J.R. Interpretation of Landsat Imagery of the Seward and Blying Sound Quadrangles, Alaska. U.S. Geol. Surv. OFR 78-737, 1979.

Nelson, S.W., J.A. Dumoulin, and M.L. Miller. Geologic Map of the Chugach National Forest, Alaska. U.S. Geol. Surv. Misc. Field Studies Map MF-1645-B, 1985, 16 pp.

Nelson, S.W., M.L. Miller, D.F. Barnes, J.A. Dumoulin, R.J. Goldfarb, R.A. Koski, C.G. Mull, and W.J. Pickthorn. Mineral Resource Potential of the Chugach National Forest, Alaska; Summary Report. U.S. Geol. Surv. Misc. Field Studies Map MF-1645-A, 1984, 24 pp.

Plafker, G. Geologic Map of the Gulf of Alaska Tertiary Province, Alaska. U.S. Geol. Surv. Misc. Geol. Invest. Map I-484, 1967.

Tysdal, R.G. Mines, Prospects, and Occurrences Map of the Seward and Blying Sound Quadrangles, Alaska. U.S. Geol. Surv. MF-880-A, 1978.

Tysdal, R.G. Map Showing Placer Deposits of the Seward and Blying Sound Quadrangles, Alaska. U.S. Geol. Surv. MF-880-B, 1978.

Tysdal, R.G., and J.E. Case. Geologic Map of the Seward and Blying Sound Quadrangles, Alaska. U.S. Geol. Surv. Misc. Invest. Series Map I-1150, 1979, 12 pp.

Wahrhaftig, C. Physiographic Divisions of Alaska. U.S. Geol. Surv. Prof. Paper. 482, 1965 (1966), 52 pp.

Williams, J.R., and K.M. Johnson. Map and Description of Late Tertiary and Quaternary Deposits, Valdez Quadrangle, Alaska. U.S. Geol. Surv. OFR 80-892-C, 1980.

Williams, J.R., and K.M. Johnson. Surficial Deposits of the Valdez Quadrangle, Alaska. Ch. in The U.S. Geological Survey in Alaska; Accomplishments During 1979. U.S. Geol. Surv. Circ. 823-B, 1981, pp. B76-B78.

Winkler, G.R., and G. Plafker. Geologic Map and Cross Sections of the Cordova and Middleton Island Quadrangles, Southern Alaska. U.S. Geol. Surv. OFR 81-1164, 1981, 25 pp.

Winkler, G.R., M.L. Silberman, A. Grantz, R.J. Miller, and E.M. MacKevett, Jr. Geologic Map and Summary Geochronology of the Valdez Quadrangle, Southern Alaska. U.S. Geol. Surv. OFR 80-892-A, 1981.

Appendix - A
Site Summaries - Chugach National Forest Mineral Materials Inventory

A total of *27 sites* were investigated in 1996. In some cases these represent existing or past gravel pits or material sites. In other instances, a site consists of a large area which has similar material characteristics. This appendix contains summaries for the following sites:

Site name	Samples collected
American Way Pit	-
Bear Pit	7
Canyon Creek Headwaters	6
Devils Creek Trailhead Road	-
East Fork Pit	5
Exit Glacier Road	4
Fly Pit	4
Hope Highway Mile 4	1
Hope Highway Mile 9	1
Hope Highway Mile 13	1
Johnson Pass Trailhead Road	-
Mile 33 Pit - Sand Pit	2
Mile 35 Pit	3
North Granite Creek Timber Road	1
Portage Valley	-
Old Sterling Highway	-
Quartz Creek Powerline	3
Quartz Creek Road	2
RS&S Quarry	1
Resurrection Creek Bench	1
Russian River Pit	4
Silvertip Pit	2
Silvertip Creek Quarry	2
Silvertip Road	-
Tern Lake Fan	11
West Juneau Creek Pit	1
West Juneau Creek Road	3
West Juneau Creek Road Rock Source	1

Additionally, some rock specimens were collected for evaluation as facing stone or decorative rock.

Each site summary includes location information, description of the site, field investigations conducted, sample numbers and type, and resource estimates (where possible).

1 American Way Pit

Location: Hope Mining Company placer claim, Resurrection Creek road

Township	Range	Section	Map	Latitude	Longitude
9N	2W	4	Seward D-8	N60 53 54	W149 38 04

Commodity: Sand and gravel; gold
Status: Reclamation
Description and site history:

This pit was to have been a cooperative venture between the USFS and the claimant. The USFS was to remove the overburden (in this case sand and gravel devoid of gold) and the claimant would then mine the pay. At the time of the visit, the pit appeared to be in the process of being reclaimed. Topsoil and stumps were being backfilled along the sides of the pit. Little in-place material was exposed and no samples were taken from the pit area due to the reclamation effort.

Field investigation:

Dates: 7/30/96

Samples: Since the pit was in the process of being reclaimed, no samples were taken. A sample was taken from the road cut 300 ft west-southwest of the pit. See the Resurrection Creek Bench summary for a description.

Material description: A 3-ft section exposed in the east end of the pit contains moderately well sorted, poorly rounded gravel. Boulders up to 2 ft in diameter are present in the pit. The material in the floor of the pit had a high silt content.

Site Potential:

This area is completely blanketed with mining claims so any mineral material leases would have to be coordinated with the mining activities of the claimants. Gold is present throughout the benches along Resurrection Creek.

Dimensions/Resource estimate:

The pit measures roughly 475 ft long in an east-west direction, and varies from 180 to 200 ft wide. It appears to have been excavated to a maximum depth of 10 ft at the east end. Extraction of material to 10 ft thoughout the pit area *would have* yielded 33,400 cubic yards of material.

Development Considerations:

Resources in this site are restricted by the depth to pay gravels. This would require constant oversight of the claimant during gravel extraction and thus make this site unattractive for a community or contractor pit.

2 Bear Pit

Location: North side of Seward Highway between Granite Creek and East Fork Creek, directly across from the East Fork Pit.

Township	Range	Section	Map	Latitude	Longitude
8N	1E	5	Seward C-7	N60 43 58	W149 19 15

Commodity: Sand and gravel; rock

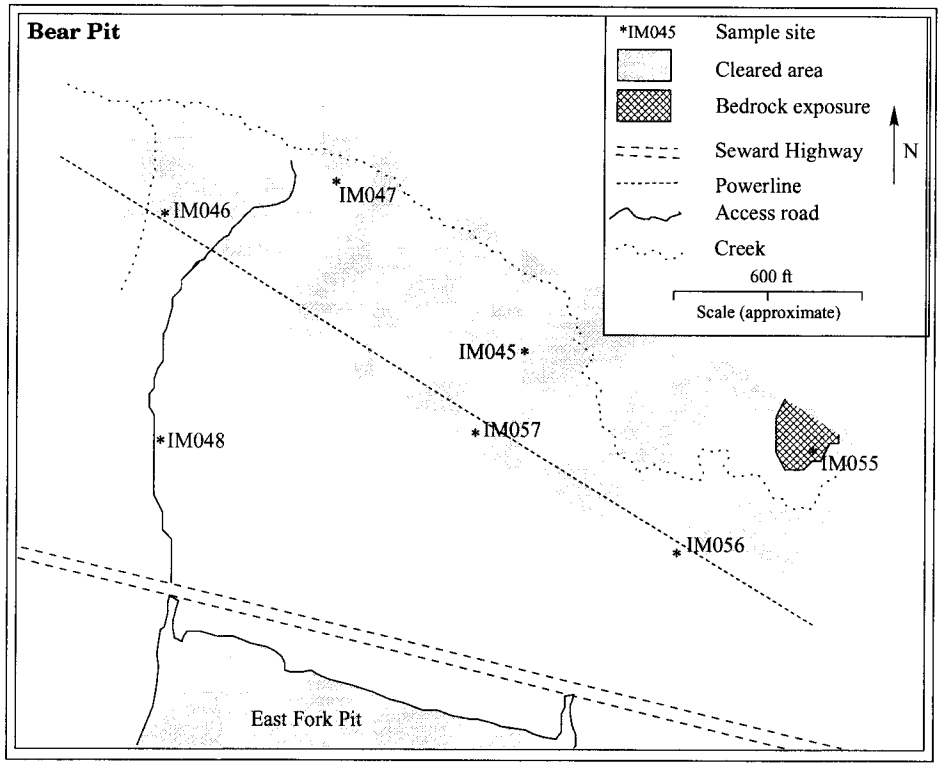
Status: Sampled by ADOT but never used.

ADOT Material Site Number: M.S. 31-2-056-1

Description and site history:

The Bear Pit (named after seeing a black bear in the area) is not really a pit; however, exploration has taken place at the site.

Bear Pit - Sample location map



The site consists of approximately 27 acres on the north side of the Sterling Highway, across from the active East Fork Pit. A powerline crosscuts that site and divides the region between the highway and the base of the mountains. In the early 1980s, this was the site of a moose habitat enhancement project.

ADOT dug twenty-nine test pits in 1986 and an additional 10 pits in 1993. Sample results indicated that of 15 samples tested, only 3 exceeded the minimum degradation value of 45 for aggregate for base course. Ten of the 15 samples exceeded the minimum degradation value of 30 for aggregate for pavement.

Field investigation:

Dates: 8/5/96 and 8/6/96

Samples:

Sample numbers and descriptions for Bear Pit

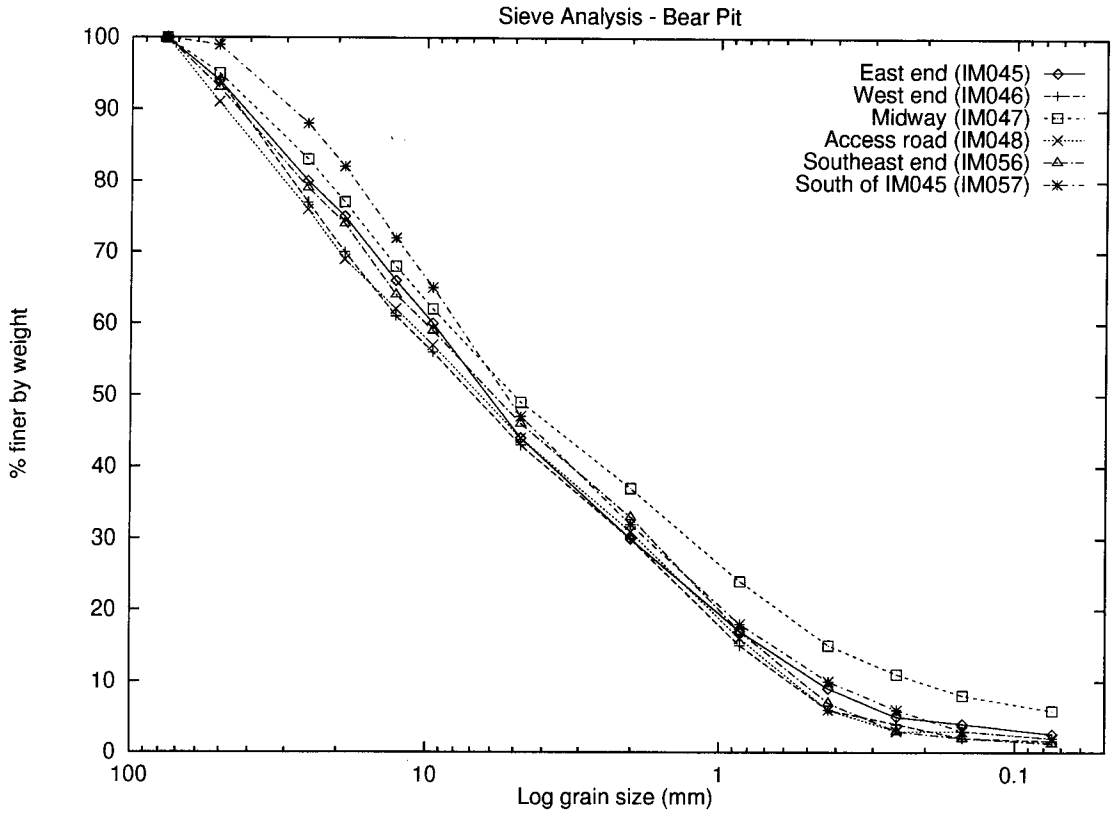
			Oversize (Lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM045	screened	east end	25	-	55.8	41.6	2.6
IM046	screened	west end	105	24	57.1	41.3	1.6
IM047	screened	midway	73	-	51.3	42.8	5.9
IM048	screened	along access road from highway	55	-	55.5	42.5	2.0
IM055	rock	rock knob at northeast end of site	NA	NA	NA	NA	NA
IM056	screened	south of power line, east end	53	20	54.1	44.6	1.3
IM057	screened	south of IM045 near powerline	10	-	52.6	45.4	2.0

Material description: The material varies across the site due to the influence of the talus/avalanche slope at the base of the mountain. Generally the material is classified as a subangular to rounded sandy gravel with moderate to poor sorting.

Sieve analysis results for Bear Pit samples

Sieve size	Diameter (mm)	IM045	IM046	IM047	IM048	IM056	IM057
3	76.2	100	100	100	100	100	100
2	50.8	94	94	95	91	93	99
1	25.4	80	77	83	76	79	88
3/4	19	75	70	77	69	74	82
1/2	12.7	66	61	68	62	64	72
3/8	9.5	60	56	62	57	59	65
#4	4.75	44	43	49	44	46	47
#10	2	30	30	37	31	33	32
#20	0.85	17	15	24	16	17	18
#40	0.425	9	6	15	6	7	10
#60	0.25	5	4	11	3	3	6
#100	0.15	4	2	8	3	2	3
#200	0.075	2.6	1.6	5.9	2	1.3	2

A rock sample (IM055) was taken from the bedrock knob at the northeast end of the site to evaluate the potential for a crushed rock/riprap source. The rock is phyllite to graywacke in composition, highly foliated, and breaks into long narrow pieces. The fracture pattern of the rock makes it unsuitable for riprap.



Site Potential:

This site has potential for borrow material and, depending on where the material is excavated, for crushed aggregate.

Dimensions/Resource estimate: 183,400 cubic yards (140,000 cubic meters). This estimate is based on a pit approximately 1,300 ft by 300 ft by 11.5 ft deep and encompasses the area northeast of the powerline and is bounded on three sides by small creeks. The depth is based on GPR data which indicate the water table is 10 ft to 13 ft below the surface. This is confirmed by prior ADOT sampling (see below). Additional reserves are available if the pit is excavated below the water table.

Development Considerations: Considerations in the development of this site include the powerline, previous moose habitat enhancement project, and partial visibility from the Sterling Highway. A pit could be sited to take advantage of natural screening. Pit depths will be limited by the shallow water table; the ADOT sampling encountered water in every test pit at a depth of 7 ft to 13.5 ft.

3 Canyon Creek Headwaters

Location: East side of Seward Highway, near Mile 41, between Canyon and Quartz Creeks.

Township	Range	Section		Map	Latitude	Longitude
6N	1W	18		Seward C-7	N60 37 04	W149 31 15

Commodity: Sand and gravel
Status: Site of past timber cut
Description and site history:

This site consists of a large alluvial fan situated at the base of the mountain between Canyon and Quartz Creeks. A road, presumably built for timber harvest, is present and extends from the highway for about 0.4 mi southeast towards the base of the unnamed mountain between Quartz and Canyon Creeks. Additional trails, passable by four wheel drive, traverse the area to the north; however these can not be considered roads. It appears timber operations ceased here several years ago.

Field investigation:

Dates: 8/9/96 and 8/10/96

Sample numbers and description for Canyon Creek Headwaters

			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM061	screened	lower end of road	105	11	70.5	27.4	2.1
IM062	screened	upslope near end of road	56	20	41.5	51.0	7.5
IM063	screened	midway down road	164	32	73.3	25.7	1.0
IM064	screened	north side road near corner	13	-	65.7	33.8	0.5
IM065	screened	northeast part of fan	2	-	60.9	34.6	4.5
IM066	screened	west side between IM061 and IM064	81	-	67.5	30.3	2.2

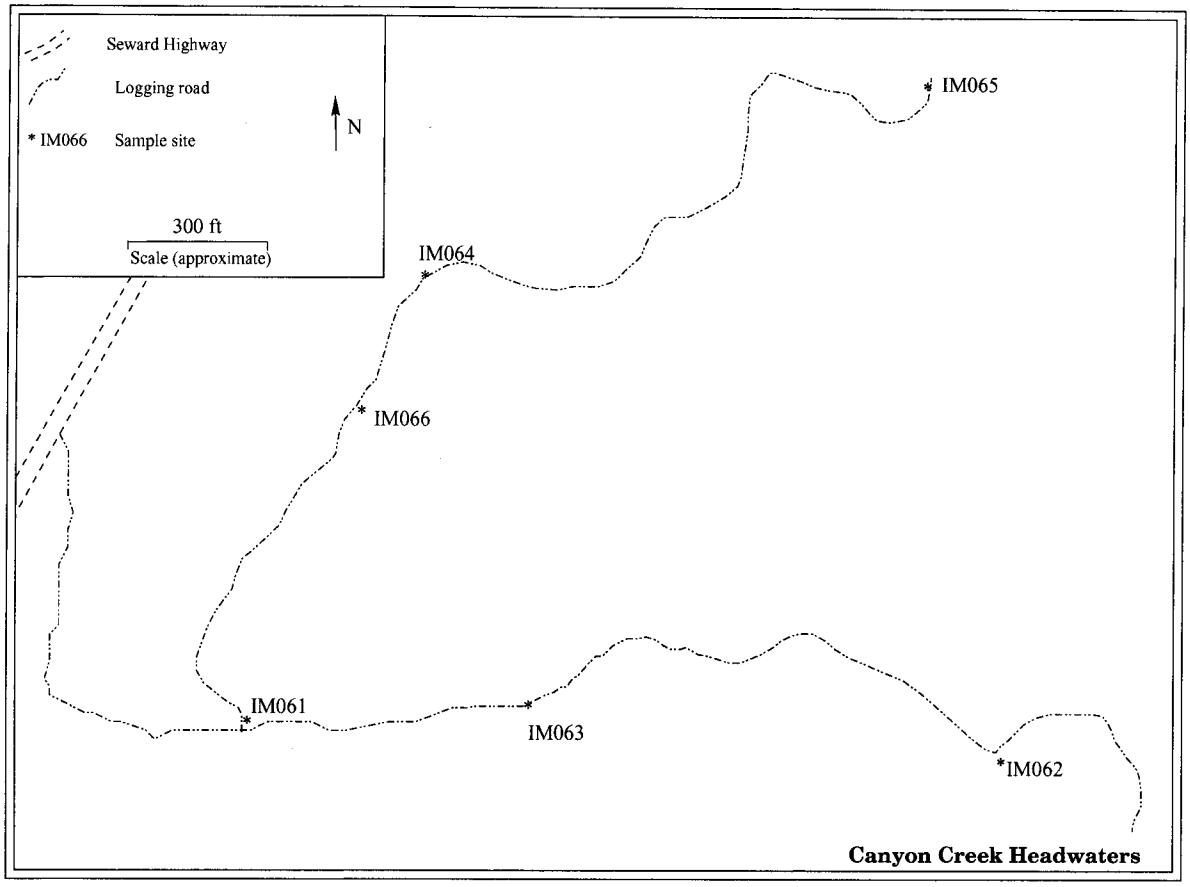
Material description:

Sieve analysis results for Canyon Creek Headwaters

Sieve size	Diameter (mm)	IM061	IM062	IM063	IM064	IM065	IM066
3	76.2	100	100	100	100	100	100
2	50.8	92	97	88	98	99	94
1	25.4	64	84	66	76	91	70
3/4	19	56	79	57	68	83	62
1/2	12.7	46	73	46	54	68	51
3/8	9.5	41	69	40	48	59	45
#4	4.75	30	59	27	34	39	32
#10	2	20	47	16	23	27	21
#20	0.85	13	34	9	11	17	12
#40	0.425	8	24	5	4	13	6
#60	0.25	5	17	3	2	10	4
#100	0.15	3	12	2	1	7	3
#200	0.075	2.1	7.5	1	.5	4.5	2.2

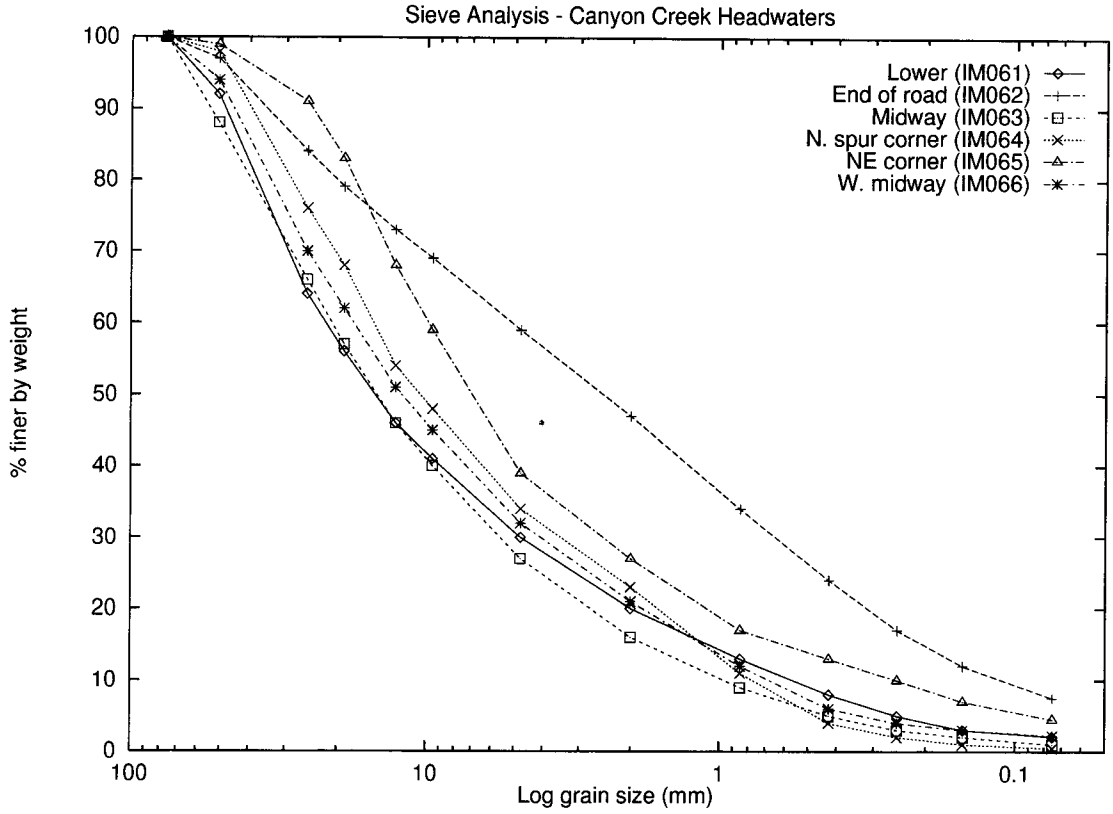
The material varies across the alluvial fan. Sampling revealed a pattern of deposition that varied from coarse (+3") cobbles with no fines to brown silt. The last depositional episode appears to have been the dumping of a mantle of coarse material over finer sands and gravels. This pattern was repeated thoughout the sample sites, although in some instances the holes were not deep enough to reveal the transition. Even though the material varies in section, generally the material is classified as a subangular to rounded sandy gravel with good to moderate sorting.

Canyon Creek Headwaters - Sample location map



Site Potential:

This site has one of the highest potentials for establishing a new material source. The site is well shielded from the highway and has been partially logged in the past. Additional sampling with a small excavator would be required to further classify this deposit. The sieve analysis reveals that the material has a size distribution similar to, and in some samples better than, the Mile 35 and Russian River pits.



Dimensions/Resource estimate: None calculated. Further examination of the site is required to estimate the reserves; however the potential for large reserves of quality material is significant.
Development Considerations: Access to this site is almost directly across from the new Summit Creek trailhead that was under construction in 1996. Visual impacts from development of the site can be easily mitigated by making use of the screening effects of existing vegetation.

4 Devils Creek Trailhead Road

Location: This road begins at the Devils Creek trailhead and heads northeast, paralleling the Seward Highway and returning to the highway at Mile 40.

Township	Range	Section		Map	Latitude	Longitude
5N	2W	2		Seward C-7	N60 33 38	W149 34 40

Commodity: Sand and gravel
Status: Inactive
Description and site history: This location has two areas that have been used to extract sand and gravel in the past. One site (near the north end of the road) has been reclaimed. The other site is approximately 0.2 mi from the south end of the road near the trailhead and consists of a small excavation in the bench on the east side of the road. The cut measures roughly 60 ft by 30 ft and the face is 12 to 18 ft high.
Field investigation:

Dates: 6/7/96

Samples: None

Material description: The material is sandy gravel with 100% -3 in at the top of the section. It is cleanly washed and well sorted. A fair amount of angular material is present in float at the toe of the pit face slope and appears to have come from just under the topsoil.

Site Potential: The pit could be extended approximately 60 ft to the east and 100 ft to the south. The material is suitable for borrow; the size distribution makes it unsuitable as a source for crushed aggregate, regardless of the quality.
Dimensions/Resource estimate: 3,300 cubic yards (2,500 cubic meters) based on expansion to 60 ft by 100 ft.
Development Considerations: Extension of the excavation would likely make it visible from the highway. In addition, there would be a potential impact on trailhead users, depending on how access to the area is achieved. The resource that could be extracted is relatively small and may not be worth the impact to other resources and uses.

5 East Fork Pit

Location: South of Seward Highway, between Granite and East Fork Creeks (between Mile 61.9 and 62.3).

Township	Range	Section	Map	Latitude	Longitude
7N	1E	5	Seward C-7	N60 43 41	W149 19 14

Commodity: Sand and gravel

Status: Active pit

ADOT Material Site Number: M.S. 31-2-055-1

Description and site history:

This is an active pit that has been in use by ADOT for a number of years. In 1986, 38 test pits ranging in depth from 4.5 to 13 ft were excavated by ADOT. An additional 17 pits were dug in 1993, with depths ranging from 12 to 19.5 ft. The water table is shallow in the pit area, varying from 4 to 12.5 ft below the surface. Analysis of the samples by ADOT revealed that only 4 of 16 tested passed the minimum degradation value of 45 for aggregate base course and only 8 passed the minimum of 30 for aggregate for pavement.[5] Despite the relatively poor sample results, the pit has been extensively used. Currently some reclamation appears to be taking place. Material from grubbing operations has been backfilled into the pit in the northeast and western portions. A pond has been created in the southwest corner of the pit. At the time of the visit, the pit was being used for storing explosives for the Hope-Y/Canyon Creek project, as well as storing various pieces of gravel plant equipment. No excavation of material was ongoing.

Field investigation:

Dates: 8/1/96

Samples:

Sample locations and descriptions for the East Fork Pit

			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM029	screened	exploratory pit	103	-	55.2	43.5	1.3
IM030	screened	woods east of pit boundary	27	-	60.6	36.7	2.7
IM031	screened	woods east of pit boundary	21	-	55.2	40.9	3.9
IM032	screened	north side road near corner	-	-	54.6	41.7	3.6
IM033	screened	northeast part of fan	2	-	57.9	39.5	2.6

No samples were taken in the existing pit area. The pit has reached it's limit to the north, west, and south. Further expansion is possible to the east and southeast; sampling was concentrated in that area.

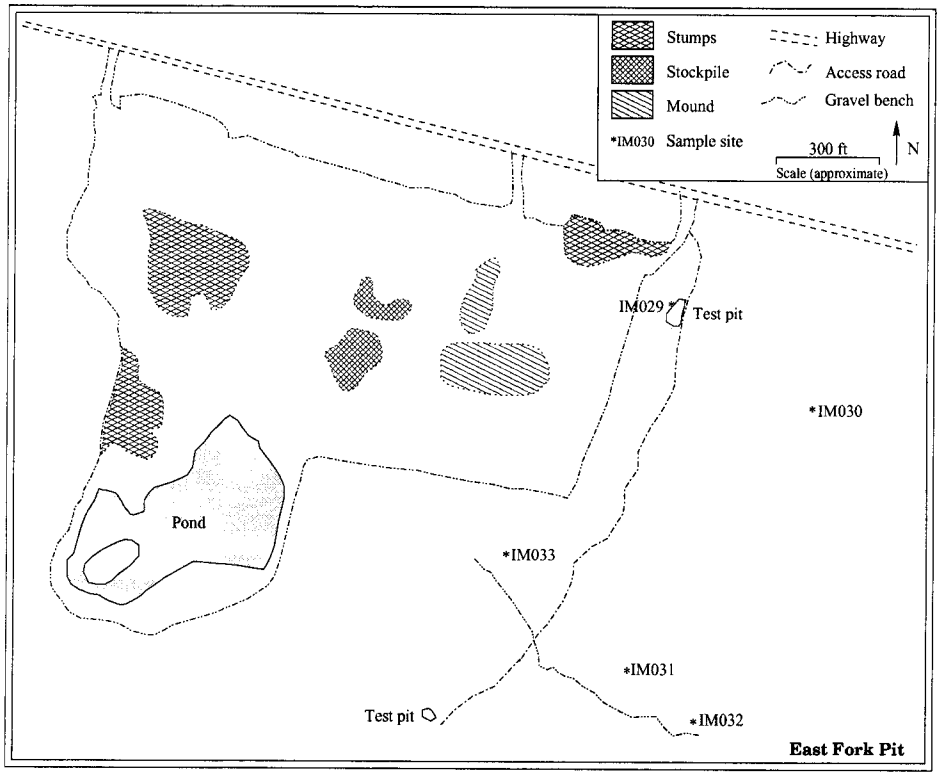
[5]Information from Material Site Summary, Alaska Dept. of Transportation files

Sieve analysis results for the East Fork Pit

Sieve size	Diameter (mm)	IM029	IM030	IM031	IM032	IM033
3	76.2	100	100	100	100	100
2	50.8	95	86	95	97	96
1	25.4	79	70	81	88	85
3/4	19	72	65	76	81	79
1/2	12.7	64	56	66	70	67
3/8	9.5	59	52	60	63	60
#4	4.75	45	39	45	45	42
#10	2	30	27	30	30	29
#20	0.85	13	14	17	17	16
#40	0.425	5	7	10	10	9
#60	0.25	3	4	7	6	5
#100	0.15	2	3	5	5	4
#200	0.075	1.3	2.7	3.9	3.6	2.6

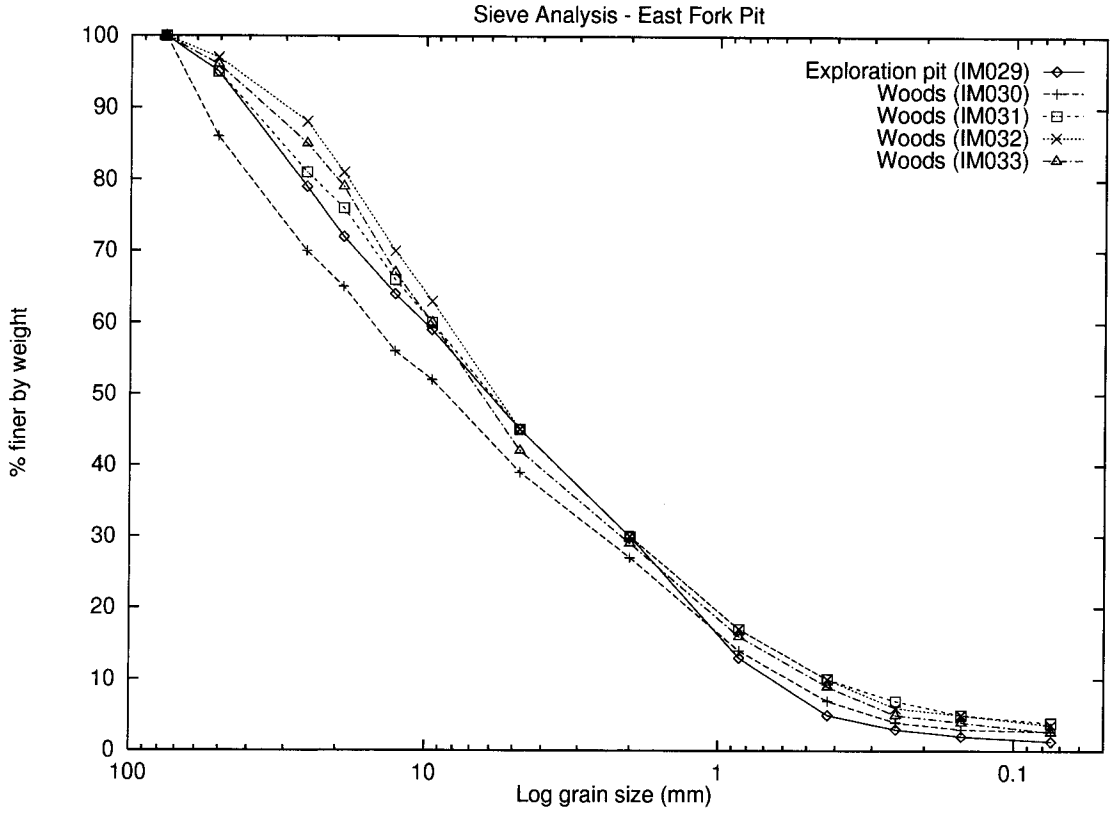
Material description: The material consists of sandy gravel that is generally rounded to subangular. The level of sorting varies; however, the material is usually moderately well sorted. This silt/clay size fraction tends to be high in some samples. Some of the cobbles exhibit a high degree of weathering and exfoliation. This likely accounts for the poor degradation test results by ADOT.

Sample location map- East Fork Pit



Site Potential:

This pit can be expanded; however, the quality of the material may not warrant additional disturbance of the ground to the east. Samples IM029 and IM030 were tested for degradation (T-13) and abrasion. Both failed to meet the minimum for use as crushed aggregate for pavement. The shallow water table prohibits deep excavation without bailing; however a plan could be devised to excavate a series of ponds which would later serve as a recreation area. A small pan sample from IM032 contained 2 to 3 colors of gold. There is potential for placer gold in the low-lying benches that parallel the highway.



Dimensions/Resource estimate: None calculated. The potential for large reserves from Silvertip Creek to the confluence of Bench and Center Creeks is significant; however the shallow water table is the limiting factor.

Development Considerations: The water table will be encountered within 10 to 15 ft of the surface. Results from the GPR survey indicate the water table to be at 10 ft in the area of the survey. To develop significant yardage, a large area will need to be cleared and excavated, or bailing will be required to excavate below the water table.

6 Exit Glacier Road

Location: Exit Glacier road, beginning at the USFS boundary (end of pavement)
Commodity: Sand and gravel; rock
Status: Undeveloped
Description and site history: The road corridor was examined to determine potential for sand and gravel and rock sources and to identify sample sites.
Field investigation:
Dates: 8/2/96
Samples:

Sample locations and descriptions for Exit Glacier Road

Sample #	Type	Location
IM036	rock	Exit Glacier overlook
IM037	rock	Exit Glacier road south of IM036
IM038	rock	Exit Glacier road off old logging road
IM039	rock	Exit Glacier road near USFS boundary

Material description: In all cases the rock consists of massive graywacke with occasional interbedded slates. The rock is generally hard and breaks with difficulty using a hammer. These samples were retained as specimens. No quality tests were conducted.
Site Potential: The material has potential for riprap or possibly crushed aggregate. Further examination would be required to define a site that is in a suitable location for development.
Dimensions/Resource estimate: None calculated
Development Considerations: The high recreational/tourism use of the Exit Glacier Road is the primary consideration in developing a quarry along the road. Further investigation is required to delineate suitable resources that are located far enough from the road to mitigate the impact of drilling, blasting, and haulage. Truck traffic on the road is a major consideration as well.

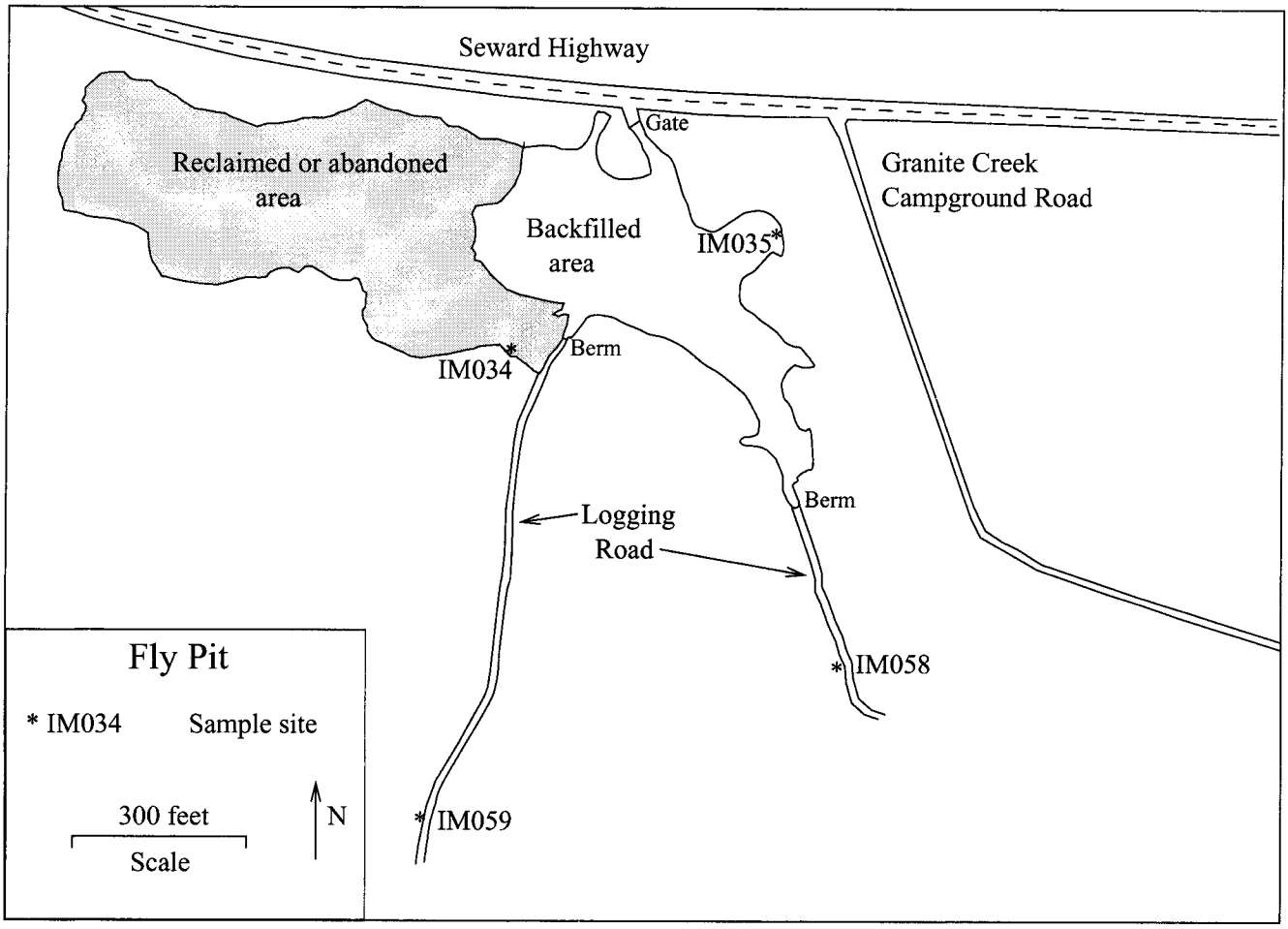
7 Fly Pit

Location: This site is located just west of the Granite Creek Campground road, on the south side of the Seward Highway.

Township	Range	Section	Map	Latitude	Longitude
7N	1E	5	Seward C-7	N60 43 38	W149 18 03

Commodity: Sand and gravel
Status: Reclamation
Description and site history: This pit consists of two sections: an older mined-out(?) section that has been left to revegetate (west end of pit) and a newer section where waste material from recent construction projects appears to have been dumped. In addition, the pit has been used as a base for logging operations. Two pioneer roads start in the pit and head south towards East Fork Creek. Both roads have been blocked with gravel barricades. The access to the pit from the highway is restricted by a USFS gate.

Sample location map - Fly Pit



Field investigation:
Dates: 8/2/96 and 8/7/96

Samples:

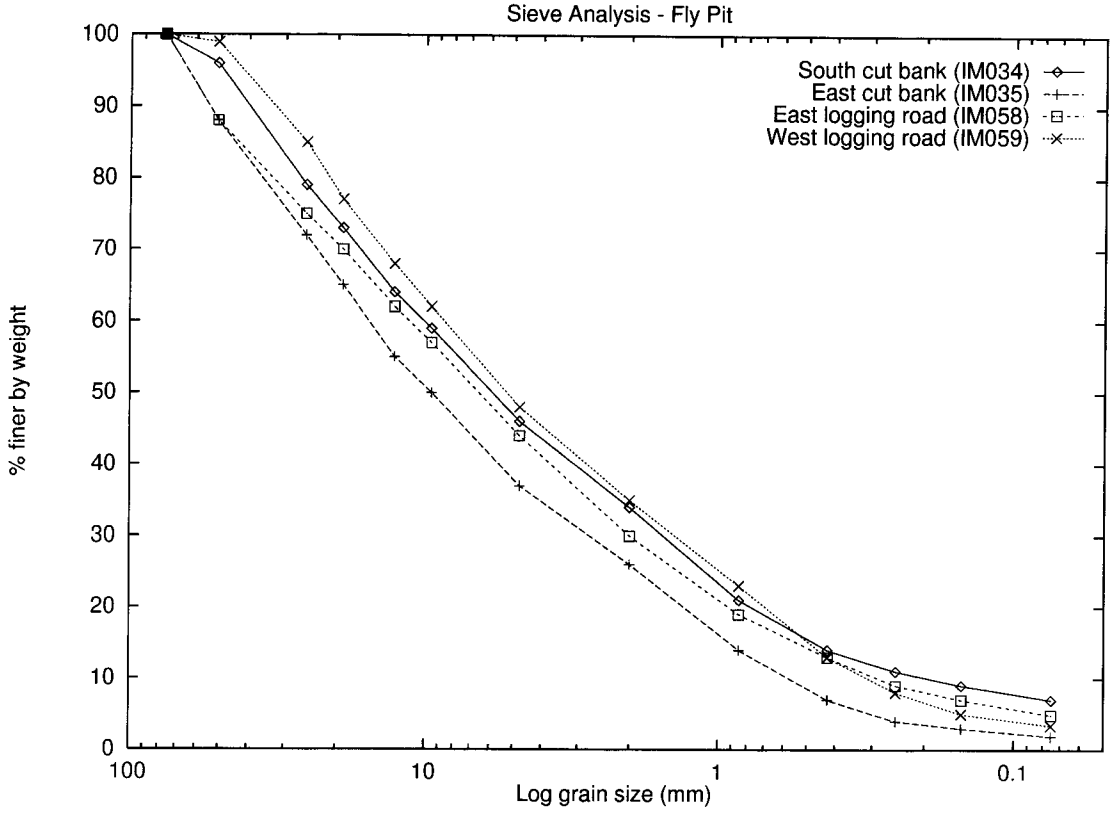
Sample numbers and descriptions - Fly Pit

			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM034	screened	south cut bank	82	11	53.8	39.2	7.0
IM035	screened	east cut bank	109	55	62.6	35.5	1.9
IM058	screened	0.1 mi south on east logging road	49	26	56.0	39.1	4.9
IM059	screened	0.2 mi south on west logging road	10	-	51.6	45.0	3.4

Material description: Samples taken in the old pit area (IM034 & IM035) consist of poorly sorted subangular to rounded silty/sandy gravel. Samples IM058 and IM059 were taken from a low bench that is visible from air photos. This bench has been formed by deposition and erosion from East Fork Creek. The samples consist of moderately well sorted to poorly sorted silty/sandy gravel that is subangular to subrounded in shape.

Sieve analysis results - Fly Pit

Sieve size	Diameter (mm)	IM034	IM035	IM058	IM059
3	76.2	100	100	100	100
2	50.8	96	88	88	99
1	25.4	79	72	75	85
3/4	19	73	65	70	77
1/2	12.7	64	55	62	68
3/8	9.5	59	50	57	62
#4	4.75	46	37	44	48
#10	2	34	26	30	35
#20	0.85	21	14	19	23
#40	0.425	14	7	13	13
#60	0.25	11	4	9	8
#100	0.15	9	3	7	5
#200	0.075	7	1.9	4.9	3.4



Site Potential: Two samples (IM035 & IM058) had quality tests conducted on them and both failed to meet the degradation criteria for use as aggregate for base or pavement. The material is suitable for use as borrow.

Dimensions/Resource estimate: Potential exists for at least 623,600 cubic yards (476,000 cubic meters) of material in the area of the Fly Pit. This is equivalent to an area of 29.5 acres and extends from the eastern logging road west to the end of the revegetated pit. GPR data indicate the water table to be at roughly 13 ft in this area.

Development Considerations: Proximity to the Granite Creek Campground and potential visibility from the highway are the major considerations. There is a very large resource available in the low-lying bench gravels of East Fork Creek. The shallow depth to the water table will limit the depth of excavation. Excavation below the water table with subsequent pond development could be used to create additional recreational facilities in the area.

8 Hope Highway Mile 4

Location: West side of Hope Highway at Mile 4

Township	Range	Section	Map	Latitude	Longitude
9N	1W	34	Seward D-7	N60 50 09	W149 25 43

Commodity: Rock; decorative stone
Status: Undeveloped
Description and site history: Rock is exposed in the road cut along the highway.
Field investigation:
Dates: 8/5/96
Samples:

Sample numbers and descriptions - Hope Highway Mile 4

Sample #	Type	Location
IM052	specimen	gray slate from road cut

Material description: The rock exposed in the cut consists of massive graywacke on the south end, brown slate in the middle, and gray slate on the north end of the cut. The gray slate exhibits a nice parallel cleavage.
Site Potential: This material has potential for decorative stone, although the resource is limited to an area of 15 ft high by 25 ft long by 10 ft wide. There may be up to 100 ft of additional material along strike.
Dimensions/Resource estimate: None calculated
Development Considerations: Proximity to the highway and impacts from drilling and blasting are the major considerations.

9 Hope Highway Mile 13

Location: North side of Hope Highway at Mile 13

Township	Range	Section	Map	Latitude	Longitude
10N	1W	30	Seward D-7	N60 55 47	W149 32 19

Commodity: rock
Status: Undeveloped
Description and site history: At mile 13 of the highway, the road nears the beach on Turnagain Arm. An access road to the beach is present on the north. Near vertical slates, phyllites, and massive graywacke are exposed forming headlands nearly perpendicular to the beach.
Field investigation:
Dates: 8/5/96
Samples:

Sample numbers and descriptions - Hope Highway Mile 13

Sample #	Type	Location
IM049	specimen	base of 35 ft cliff on the east
IM050	specimen	base of 20 ft cliff on the west

Material description: The rock consists of slate, phyllite, and graywacke that exhibits a sub-parallel cleavage. The slates in the eastern cliff (35 ft high) are carbonaceous. The headland to the west is composed of massive graywacke.
Site Potential: The material could potentially have use as decorative stone; however, the site is not conducive to extraction (see Development Considerations).
Dimensions/Resource estimate: None calculated
Development Considerations: The proximity of this site to the road and the beach, as well as visibility from across Turnagain Arm limit the potential of this site.

10 Johnson Pass Trailhead Road

Location: Road leading to the Johnson Pass trailhead between Petes Creek and Granite Creek.

Township	Range	Section	Map	Latitude	Longitude
7N	1E	4,9	Seward C-7	N60 43 44	W149 16 21

Commodity: Sand and gravel
Status: Reclaimed
Description and site history: There is evidence of a former shallow pit that was likely used in construction/modification of the Seward Highway or the trailhead road itself. The pit has been reclaimed and the road passes through the middle of it. Since the excavation was shallow, the surface expression of the pit is not very evident.
Field investigation:

Dates: 8/6/96

Samples: None

Material description: A brief examination of the material on the periphery of the former pit was conducted to determine if it warranted sampling. The material noted on the east side contained a fair amount of angular to subangular cobbles, indicating the influence of avalanche debris or talus slope material. No samples were collected.

Site Potential: This site has been reclaimed; the edge of the pit to the east is bounded in material that appears to be unsuitable for development, and the site is readily visible from the highway and/or the trailhead road. Due to these factors, the potential for development here is considered low.
Dimensions/Resource estimate: None calculated
Development Considerations: Impact on recreational use and visibility from the road are major considerations. As with other deposits along East Fork Creek, the shallow depth to the water table limits the resource and requires excavation of large shallow areas to develop significant yardage.

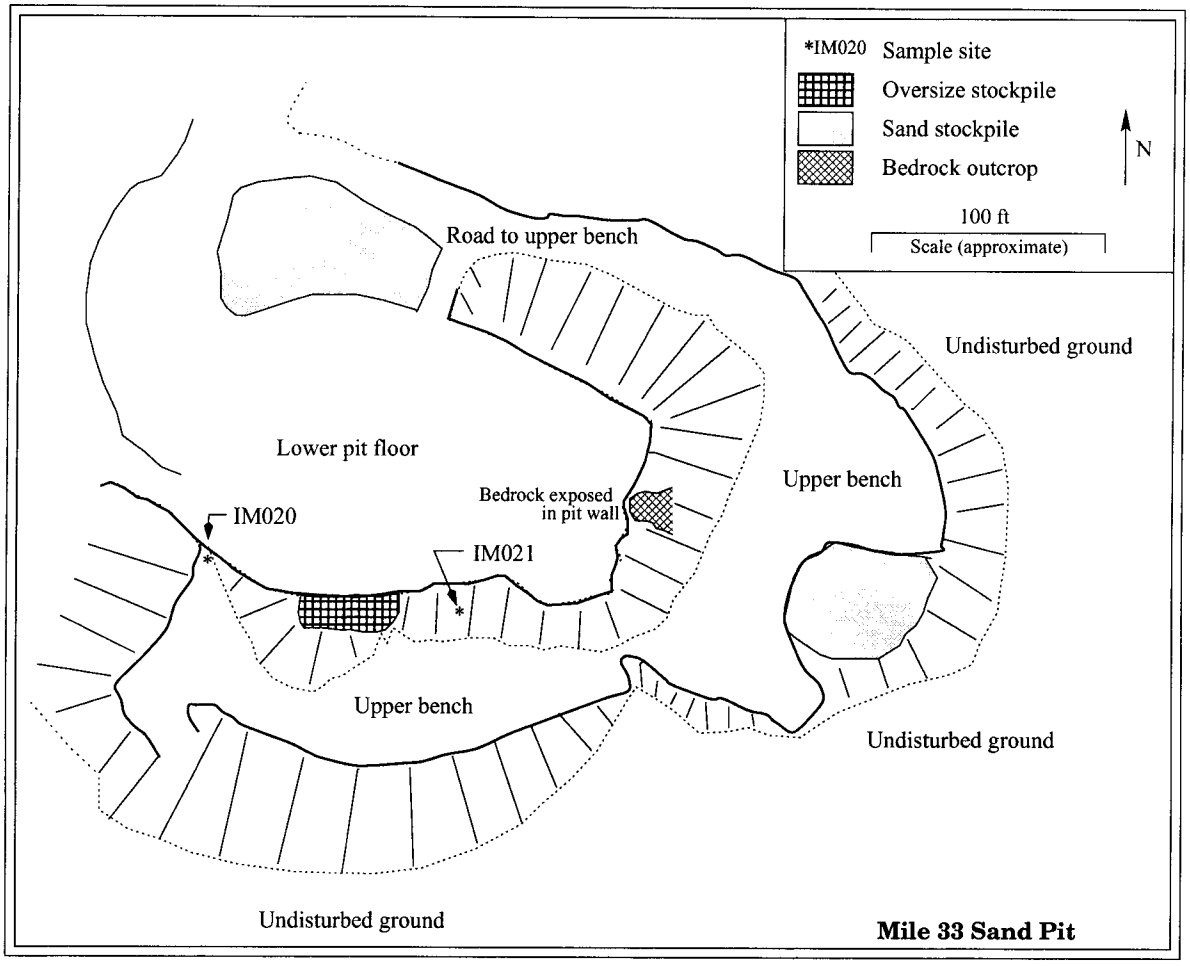
11 Mile 33 Sand Pit

Location: Mile 33 of the Seward Highway, near the Carter Lake Trailhead

Township	Range	Section	Map	Latitude	Longitude
5N	1W	21	Seward	N60 30 47	W149 27 00

Commodity: Sand and gravel
Status: Active
Description and site history: The pit has been excavated into a hill on the south side of the Seward Highway. There is a USFS gate across the road leading to the pit. According to ADOT files this pit has been used mainly as a source for road-sanding material in the winter. Material is actively being sold/given away from this pit. The operator of the sand screening operation indicated to USFS that the sand in the southwest end of the pit is poorer quality than that in the southeast end.

Sample location map - Mile 33 Sand Pit



Field investigation:

Dates: 5/28/96, 6/1/96, and 6/4/96

Samples:

Sample numbers and descriptions - Mile 33 Sand Pit

			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM020	grab	face on west side of pit	-	-	8.2	83.4	8.4
IM021	grab	face at southeast end of pit	-	-	0	66.5	33.5

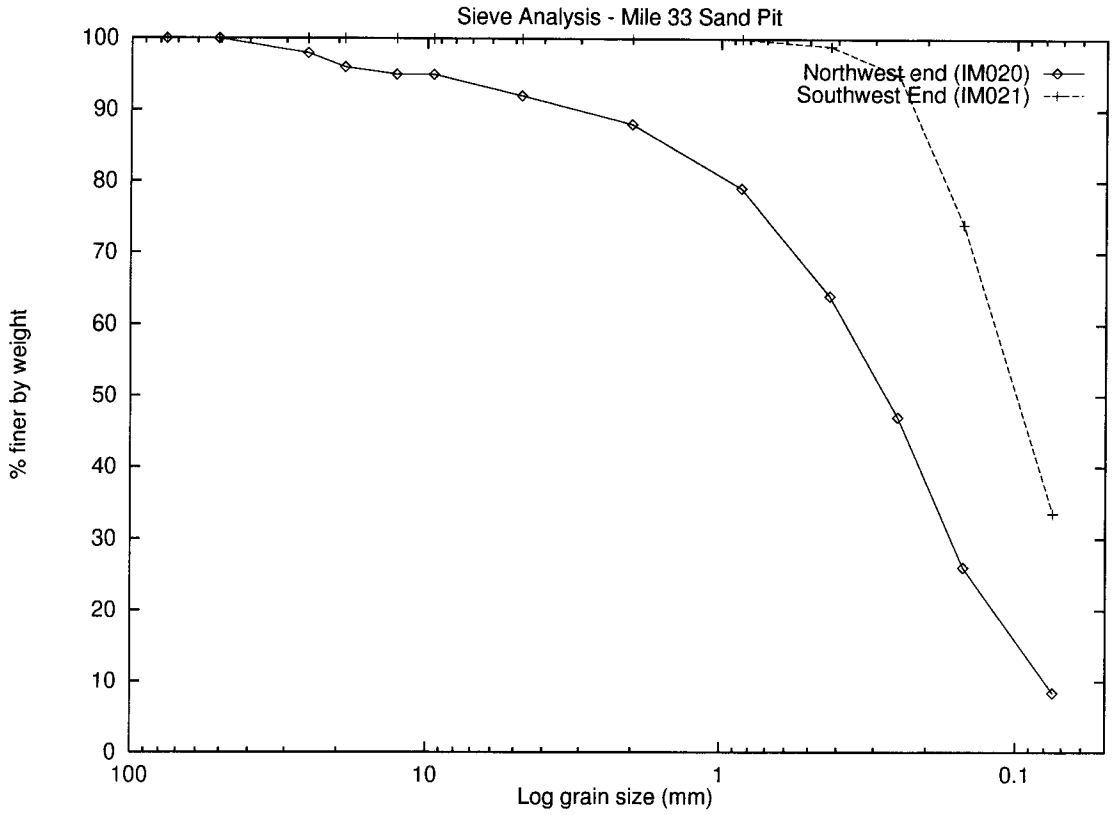
Material description: More than 90% of the material in the pit is -3 in. Cross bedded sands with interbedded gravels and channels are evident in the face of the pit. The channel gravels are well sorted, rounded, and graded. The majority of the gravels are -3 in and gravels as a whole make up only a small portion of the material exposed in the pit. Iron staining and some iron cementation was noted in the channel gravels. Silt/clay sized material is present in the pit. The section below the graded gravel channel above sample IM021 was found to be:

Depth (ft)	Material
0-5	sand
5-6	silt/clay "thixotropic"
6-7	silty gravel - poorly washed - "muddy"
7-8	silty sand - fine grained
8-	cleanly washed sandy gravel sized 1/2 in to - 1 in

The pit has been benched on three levels. The lower face has bedrock exposed in a small area (less than 8 ft x 6 ft). The -2 in aggregate from a screening operation is stacked on the southwest side of the pit. A small stockpile of sand is present on the northwest side of the pit.

Sieve analysis results - Mile 33 Sand Pit

Sieve size	Diameter (mm)	IM020	IM021
3	76.2	100	100
2	50.8	100	100
1	25.4	98	100
3/4	19	96	100
1/2	12.7	95	100
3/8	9.5	95	100
#4	4.75	92	100
#10	2	88	100
#20	0.85	79	100
#40	0.425	64	99
#60	0.25	47	95
#100	0.15	26	74
#200	0.075	8.4	33.5



Site Potential: Additional resources are present at this site; however the exposed bedrock in the lower bench indicates that further operations will eventually have to proceed on the second and third bench levels.
Dimensions/Resource estimate: Minimum of 12,200 cubic yards (9,300 cubic meters). This estimate is based on excavating the existing pit floor down 13 ft and does not include further expansion of the pit. GPR results indicate that bedrock is present 13 ft below the surface from the midpoint of the pit floor to the eastern end.
Development Considerations: Visibility from the highway is the only consideration in further development of this site. The sand "highwall" can be seen from the highway when headed east. Further development towards the south will likely increase the visibility of the pit.

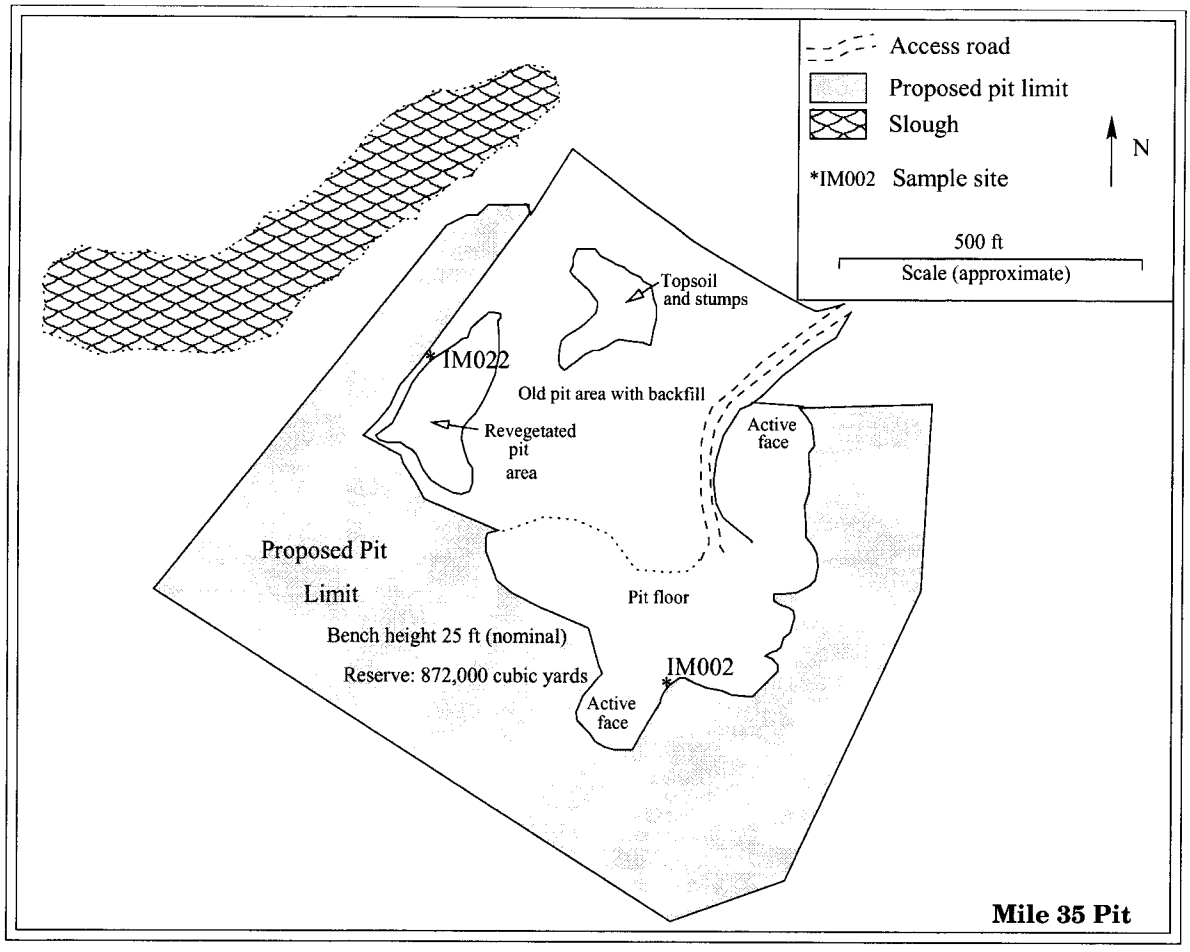
12 Mile 35 Pit

Location: Mile 35 of the Seward Highway between Tern Lake and the Carter Lake Trailhead

Township	Range	Section	Map	Latitude	Longitude
5N	1W	17	Seward C-7	N60 31 06	W149 29 00

Commodity: Sand and gravel
Status: Active
ADOT Material Site Number: MS-31-1-703-1
Description and site history: This pit has been in use for many years. Portions of the pit have been used to dispose of overburden, topsoil, stumps, asphalt, and oversize from screening operations.

Sample location map and potential reserve - Mile 35 Pit



The pit is located between two avalanche chutes. A bedrock knob between the chutes protects the pit area and thus far avalanche debris has not been encountered in the pit. In the west end of the pit is an old area of excavation that has revegetated. From its west end, it extends 120 ft to a 10 ft high bench, and another 55 ft to a break in slope above a wetland area. The practical pit limit to the west is the first (120 ft) break in slope. To the south the face could be extended at least 200 ft without encountering the avalanche debris. The north pit face could be extended at least 200 ft to the east, along the entire length of the face. The topography is fairly level.

Field investigation:

Dates: 5/28/96 and 6/7/96

Samples: Two samples were taken from the Mile 35 Pit to characterize the gravels at the active face and

those in the old portion of the pit.

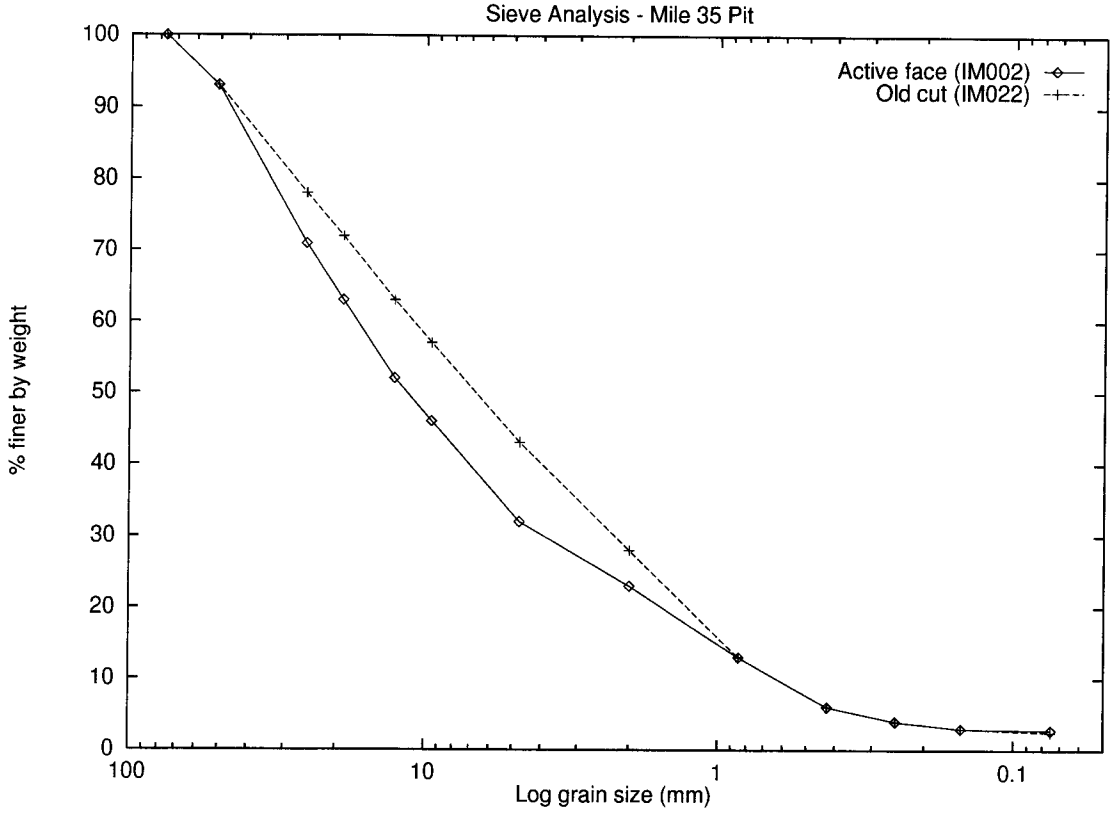
Sample numbers and descriptions - Mile 35 Pit

			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM002	screened	active face on west side of pit	94	6	67.7	29.5	2.8
IM022	grab	old cut bank on north side of site	12	13	56.7	40.8	2.5

Material description: The material at both sample sites is poorly sorted and poorly rounded. The sample taken at the active face (IM002) contains enough of a silt/clay size fraction to be moderately cemented and difficult to dig with a shovel. The material on the west side of the pit (IM022) contains more sand and is easier to excavate. The coarser part of the sediments consist of metasandstone, quartz, and graywacke cobbles.

Sieve analysis results - Mile 35 Pit

Sieve size	Diameter (mm)	IM002	IM022
3	76.2	100	100
2	50.8	93	93
1	25.4	71	78
3/4	19	63	72
1/2	12.7	52	63
3/8	9.5	46	57
#4	4.75	32	43
#10	2	23	28
#20	0.85	13	13
#40	0.425	6	6
#60	0.25	4	4
#100	0.15	3	3
#200	0.075	2.8	2.5



Site Potential: This site has considerable potential for further extraction of sand and gravel. The quality tests on the material indicate that it is not usable for aggregate (either for base or pavement) but is a good source of borrow material.

Dimensions/Resource estimate: 22 acres, 872,000 cubic yards (667,000 cubic meters)

The resource estimate assumes a nominal bench height of 25 ft. This is slightly less than the current height of the active face at the south end of the pit and accounts for variations in bench height across the proposed pit area. The area of proposed pit expansion shown on the site map is based on the topography, drainage, and location of the avalanche chutes.

Development Considerations: Further development of this pit requires establishment of a pit management plan. Random dumping of waste materials will cause difficulties in exploiting the resource. The site is well screened from the Seward Highway. Preproduction development would consist of removing trees (much of it beetle kill) and establishing access points and removing existing waste material where required. GPR results indicate that the water table is 26 ft below the surface of the pit floor and therefore is not a factor in developing the reserves outlined above.

13 North Granite Creek Timber Road

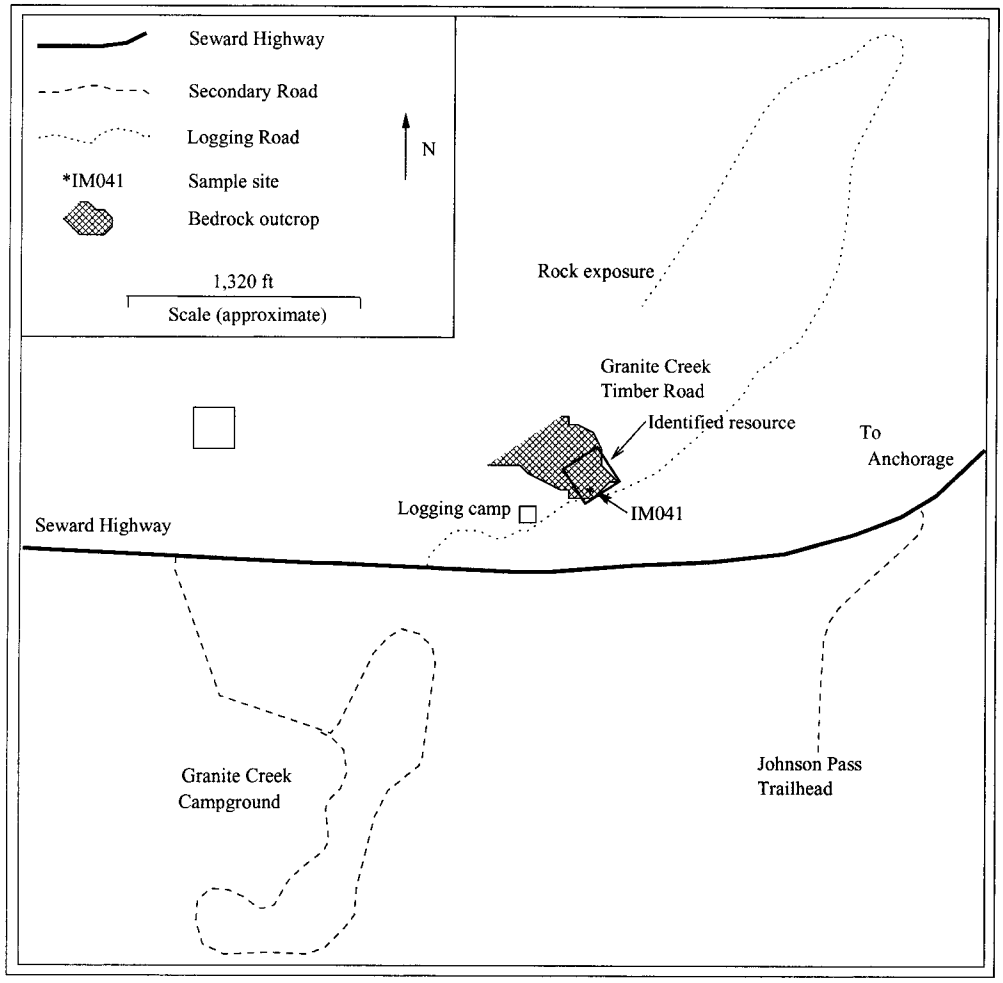
Location: Timber sale/salvage road on the north side of the Seward highway near the Granite Creek campground entrance.

Township	Range	Section	Map	Latitude	Longitude
7N	1E	4	Seward	N60 43 44	W149 17 00

Commodity: rock
Status: Undeveloped
Description and site history:

This site had active salvage logging ongoing in 1996. The road construction and logging operations have exposed several outcrops of metasandstone. There has been no excavation of materials from this site, other than that needed for road construction associated with the logging operation.

Sample location map - North Granite Creek Timber Road



Field investigation:

Dates: 8/3/96

Samples:

Sample numbers and descriptions - North Granite Creek Timber Road

Sample #	Type	Location
IM041	rock	rock exposure on north side of road near logging camp

The road was surveyed using GPS. There are two primary rock exposures along the road: one at the end of the road and one near the logging camp.

Material description: The rock exposure at the end of the road consists of argillaceous slate which breaks into sharp flat pieces. The rock is too soft for riprap or crushed aggregate and no samples were taken. The rock exposure near the logging camp consists of a hard, dark gray metasandstone with interbedded phyllite/argillaceous units. The exposure parallels the road for approximately 250 ft. The bedrock knob is approximately 40 ft high. Additional bedrock is exposed near the camp.

Site Potential: The quality test results (see Appendix B) indicate this site has potential as a source for riprap and crushed aggregate for pavement. The test results indicate that the rock is unsuitable for use as aggregate for base.

Dimensions/Resource estimate: Assuming a specific gravity of 2.7 for the rock, a 250 ft x 250 ft quarry area, and a stepped bench to 40 ft high, there is potential for a minimum of 200,000 tons (181,000 mt) of material. This estimate includes only material readily accessible in the area where trees have been logged off. Greater resources are present as the bedrock continues up the slope and is also exposed in logged off areas.

Development Considerations: The site is fairly well shielded from the highway. Proper site planning would allow for extraction of material with a minimum of disturbance to the area. Blasting would be heard at the Granite Creek campground and the Johnson Pass Trailhead. This could be minimized by use of impact breakers and small rounds of explosives.

14 Old Sterling Highway

Location: The road is constructed on the bench above the the southeast side of Daves Creek. The USFS land extends discontinuously along the road from Tern Lake to the Crescent Creek campground.

Township	Range	Section	Map	Latitude	Longitude
5N	2 & 3W	various	Seward B-8, C-7, C-8	N60 31 00	W149 39 00

Commodity: Sand and gravel; rock
Status: Undeveloped
Description and site history:
Field investigation:

Dates: 6/3/96 and 6/6/96

Samples: No samples were taken.

Material description: The majority of the material within the USFS boundary along the road is avalanche debris or bedrock. Random test holes along the road revealed material that was unsuitable for further sampling. The rock along the road is a highly fractured slate unsuitable for riprap or building stone. A worked out, overgrown pit located along the road was examined and found to be on State land.

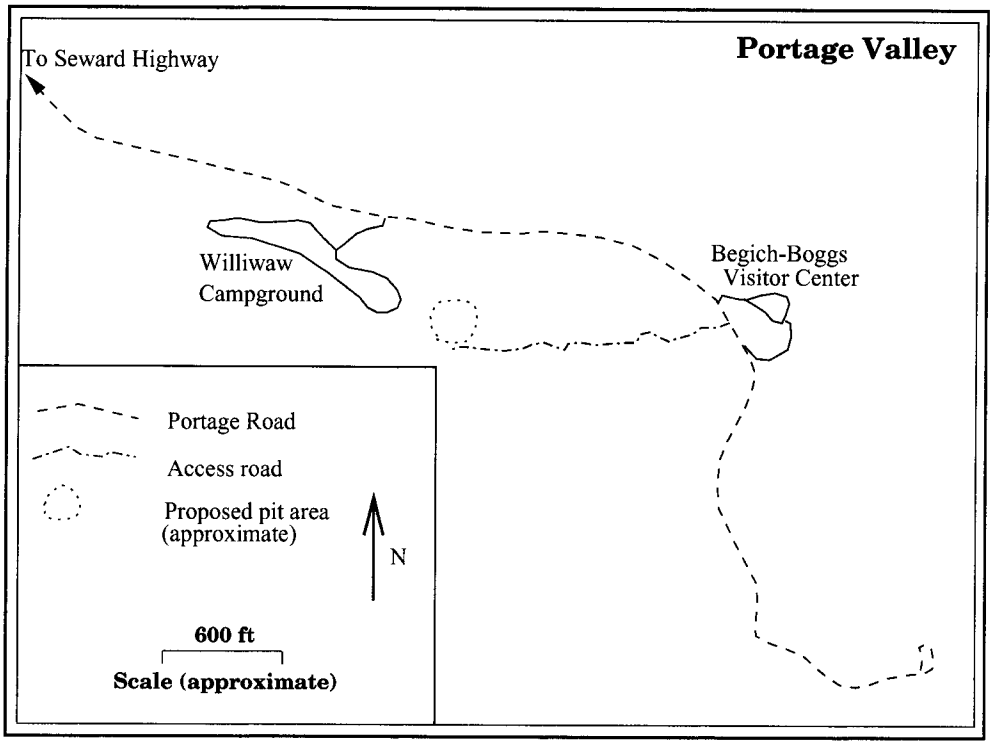
Site Potential: Reconnaissance of the road revealed no material worth sampling. There may be potential along the road; however much of the material on the USFS land is either avalanche debris or fractured bedrock. Additional examination may locate potential sites; however, based on the current examination, other sites hold more potential for development.

Dimensions/Resource estimate: None calculated.

Development Considerations: The road is narrow and overgrown. Development of a material site would require additional road construction. Pit operations may be visible from the Sterling Highway to the northwest.

15 Portage Valley

Location: Portage road from Seward Highway to the Begich-Boggs Visitor Center
Commodity: Sand and gravel
Status: Reclamation/New development
Description and site history: The valley has been exploited for sand and gravel for many years. There are no active pits at the present time; however construction of the Whittier access road may result in development of additional resources.
Field investigation:
Dates: 8/10/96
Samples: None taken
A GPR line was run at the proposed pit area east of the Williwaw Campground.
Site Potential: There is potential for additional sand and gravel within the valley. The majority of the potential lies near the end of the road and across Portage Creek to the northeast.
Dimensions/Resource estimate: None calculated
Development Considerations: The major consideration in development in the valley is the impact on tourism. Truck traffic over the heavily traveled road is a major consideration during the tourist season.



16 Quartz Creek Powerline

Location: Powerline corridor from Quartz Creek bridge on the Sterling Highway to the point where the powerline crosses the highway to the south.

Township	Range	Section	Map	Latitude	Longitude
5N	2W	16,17,19,20,30	Seward C-8, B-8	N60 32 00	W149 38 15

Commodity: Sand and gravel
Status: Undeveloped
Description and site history: The powerline can be accessed from the point where it crosses the highway or from a road on the west side of the highway, approximately 0.5 mi from the crossing. The road begins on State land and extends for approximately 2.5 mi to the north-northwest. The upper portion of the road extends into USFS land.
Field investigation:
Dates: 8/8/96 and 8/10/96
Samples:

Sample numbers and descriptions - Quartz Creek Powerline

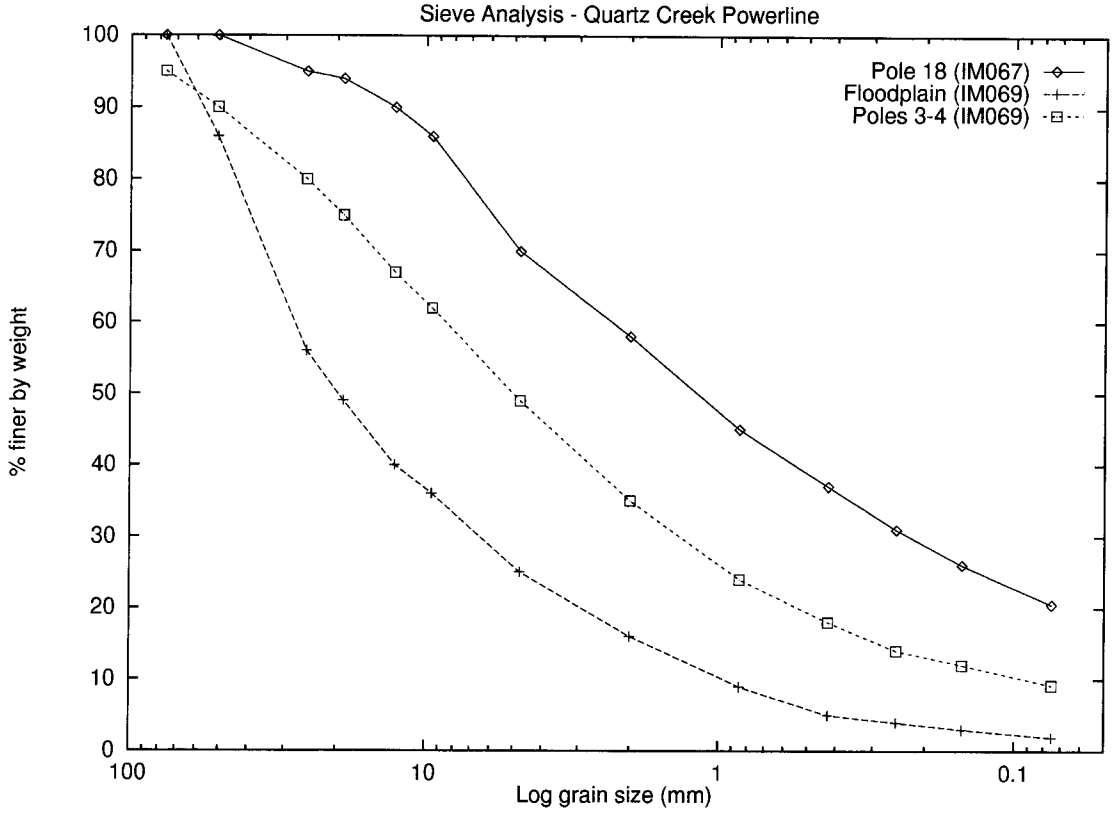
			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM067	grab	pole #18	not recorded	not recorded	29.8	49.7	20.5
IM068	grab	floodplain	not recorded	not recorded	74.6	23.4	1.9
IM069	grab	between poles #3 & #4	not recorded	not recorded	50.8	40.0	9.2

This area was not examined in detail because of time constraints and priorities. After using GPS to map the road and overlaying it with the land status in GIS, it was learned that the upper portion of the road extends into the CNF. The benches accessed by the road and the powerline have potential to provide a large volume of material. Reconnaissance samples were taken along the powerline. Only the sample from the Quartz Creek floodplain has a low silt/clay content.

Material description: The material generally has a relatively high silt/clay content, except for the sample from the floodplain. Existing pits along the access road revealed poorly washed material with a relatively high silt/clay content.

Sieve analysis results - Quartz Creek Powerline

Sieve size	Diameter (mm)	IM067	IM068	IM069
3	76.2	100	100	95
2	50.8	100	86	90
1	25.4	95	56	80
3/4	19	94	49	75
1/2	12.7	90	40	67
3/8	9.5	86	36	62
#4	4.75	70	25	49
#10	2	58	16	35
#20	0.85	45	9	24
#40	0.425	37	5	18
#60	0.25	31	4	14
#100	0.15	26	3	12
#200	0.075	20.5	1.9	9.2



Site Potential: This area has potential for borrow and possibly aggregate for pavement. Additional sampling is needed along the USFS portion of the access road to determine the quantity and quality of the material.

Degradation and L.A. abrasion tests were run on sample IM068. The results (38 and 19 respectively) indicate that the material is suitable for aggregate for pavement but not for base aggregate.

Dimensions/Resource estimate: None calculated

Development Considerations: Should the material along the access road prove suitable for extraction, the road would have to be widened to allow for haulage. Visual impacts would be negligible given the distance from existing trails and the highway. Extraction of materials adjacent to the powerline would require construction of an access road.

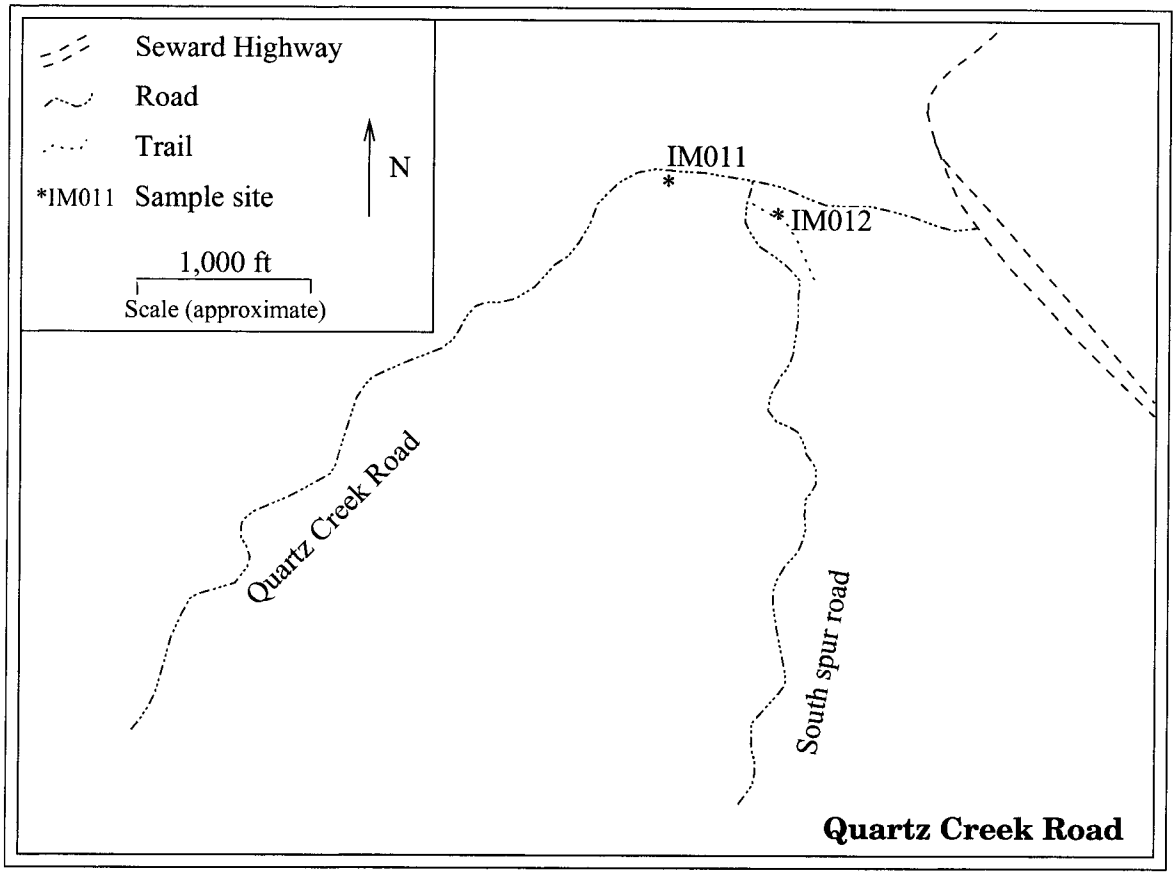
17 Quartz Creek Road

Location: North side of highway on the curve between Jerome Lake and Devils Creek Trailhead.

Township	Range	Section	Map	Latitude	Longitude
5N	2W	2-3	Seward C-7	N60 33 04	W149 34 55

Commodity: Sand and gravel
Status: Undeveloped
Description and site history: This road was apparently constructed for a timber sale; however, no logging had taken place. The road also provides access to mining claims on Quartz Creek.

Sample location map - Quartz Creek Road



Field investigation:
Dates: 6/1/96
Samples:

Sample numbers and descriptions - Quartz Creek Road

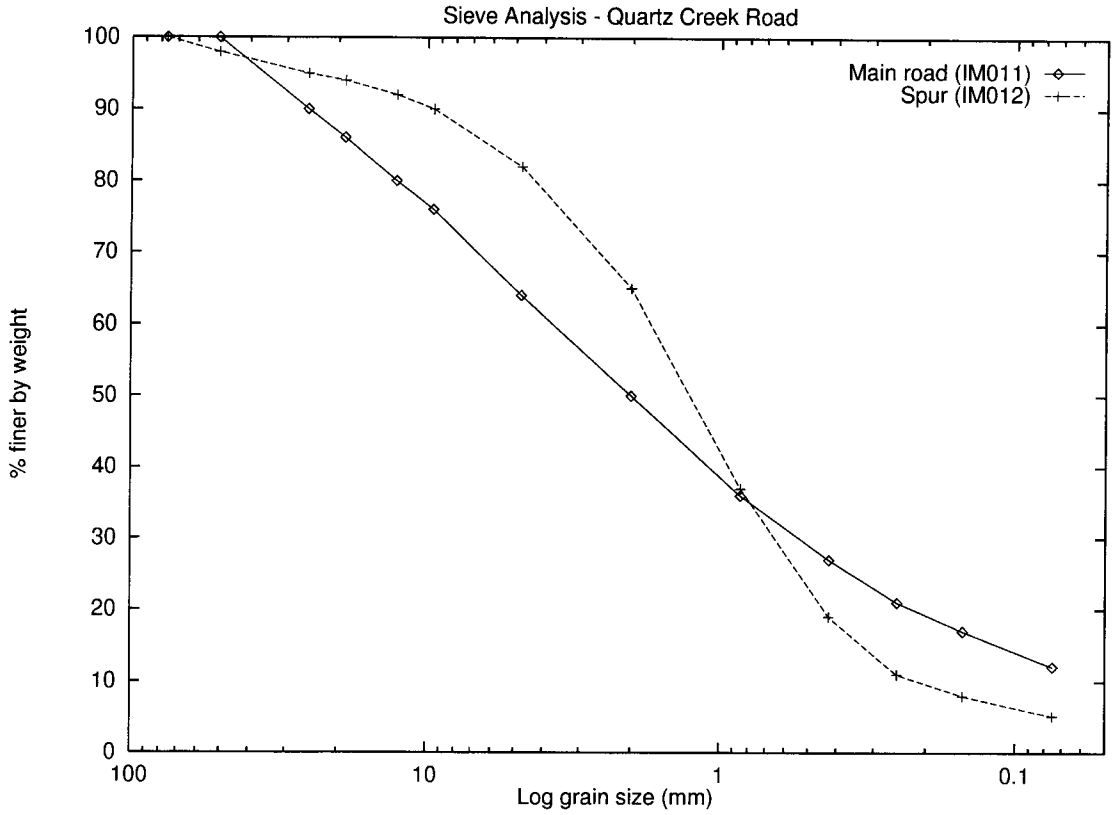
			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM011	grab	cut bank on road	not recorded	not recorded	35.7	52.2	12.1
IM012	grab	spur road	-	-	18.2	76.6	5.2

Material description: The material varies along the road. It generally has a high silt/clay content with little oversize. At the site of IM011, the material is sandy gravel with approximately 95% of the material being -3 in. The sample was taken from a cut bank on the south side of the road. The cut bank east of this sample site is very sandy gravel with cobbles and boulders to +14 in intermixed. Sandy gravel makes up greater than 80% of the material. The rocks along the road are primarily graywacke and metasandstone.

Some phyllite with pyrite was noted as well as quartz. Sample IM012 was taken from a site 200 feet off of the south spur road that leaves the main road just above Jerome Creek. The material is exposed in a pioneer road cut that trends southeast from the spur road. The material appears to be an alluvial fan or lake beach deposit with -1/2 in sandy gravels and sand. Test holes dug in the pioneer road at the sample site revealed that the material 10 ft up the road from IM012 is sand grading to silt to a gravely layer at 24 in. A hole directly across from the sample site revealed material the same as IM012. A test hole 10 ft down the road from IM012 revealed sandy gravel with fine silt/clay at a depth of approximately 12 in. Upslope 50 ft from IM012 a test hole revealed highly iron cemented sandy gravels. This deposit is complex and non-uniform; excavation of test pits would be required to evaluate the potential of this site.

Sieve analysis results - Quartz Creek Road

Sieve size	**Diameter (mm)**	**IM011**	**IM012**
3	76.2	100	100
2	50.8	100	98
1	25.4	90	95
3/4	19	86	94
1/2	12.7	80	92
3/8	9.5	76	90
#4	4.75	64	82
#10	2	50	65
#20	0.85	36	37
#40	0.425	27	19
#60	0.25	21	11
#100	0.15	17	8
#200	0.075	12.1	5.2



Site Potential: Gravels along the Quartz Creek Road may have potential for use as borrow material. Additional excavation would be required to determine the nature of the deposit(s). Based on the appearance of the material, its potential as a significant sand and gravel resource is considered low. Potential for production of sand is present; however, additional excavation would be required to determine the nature of the deposit.

Dimensions/Resource estimate: None calculated

Development Considerations: The existing road would provide easy access to the site. The presence of mining claims along the road needs to be considered in any potential lease sales or extraction.

18 RS&S Quarry

Location: Sterling Highway approximately 1 mile west of the junction with the Seward Highway.

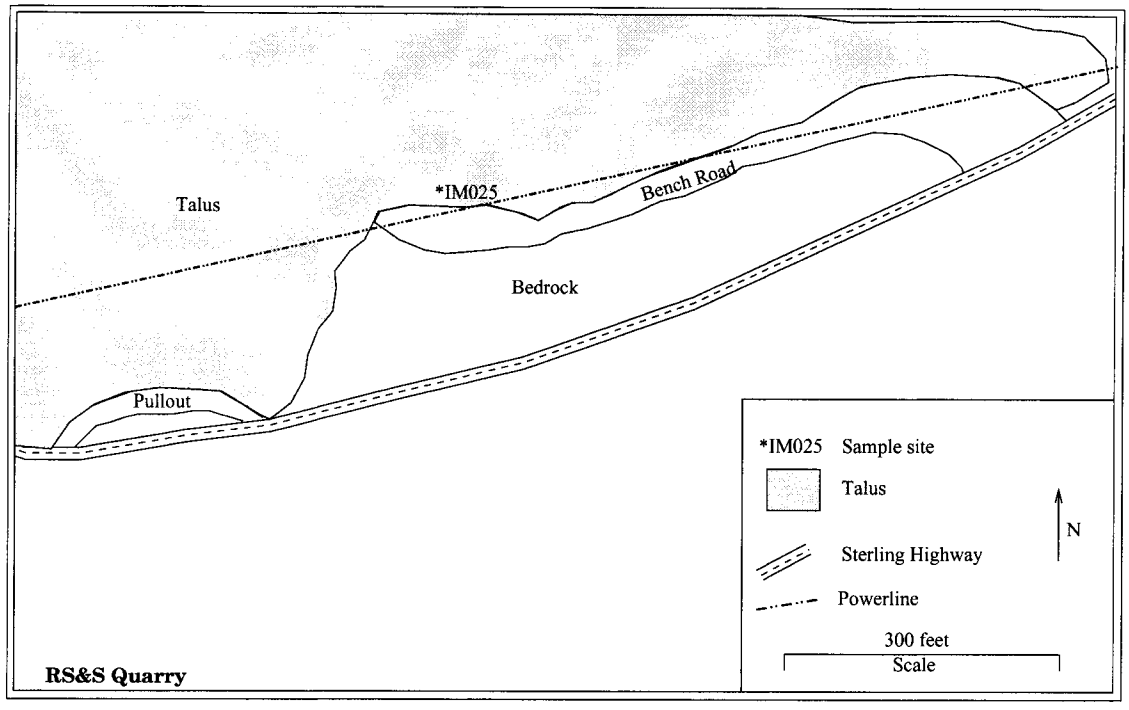
Township	Range	Section	Map	Latitude	Longitude
5N	2W	11	Seward C-7	N60 32 03	W149 34 26

Commodity: Riprap, crushed aggregate, decorative stone
Status: Casual use by individuals
Description and site history:

The RS&S consists of an outcrop and talus of metasandstone that weathers to a buff color. At one time this site was staked as a claim for uncommon variety material. The reasoning was the buff color made the material unique and decorative, therefore uncommon. The material has since been determined to be non-locatable and the site is a source of rock on a permit basis.

A powerline is present across the face of the talus slope. No large-scale extraction is ongoing.

Sample location map - RS&S Quarry



Field investigation:

Dates: 6/6/96 and 6/8/96
Samples:

Sample numbers and descriptions - RS&S Quarry

Sample #	Type	Location
IM025	rock	select sample from talus above road

Measurements were taken to estimate the resource at the RS&S Quarry. The face of the slope was measured to determine the length of the talus slope containing the "buff" colored rock. A tape survey 1,077 ft long revealed that the rock overlays a phyllite layer that is nearly schistose. Further investigation revealed that the rocks are a highly interbedded sequence of phylite and metasandstone. The thickness of these beds varies; however, at the main RS&S site a particularly thick bed of metasandstone forms the deposit. This bed is estimated to be 300-500 ft thick (apparent thickness) and is bounded on both sides by phyllite. The

apparent dip of the contact is 45 to 60 degrees to the southwest; thus to the east the metasandstone forms a blanket of varying thickness over the phyllite, while to the west it is entirely metasandstone.

Material description: The metasandstone is covered with black lichen on the surface while material below the surface of the talus slope weathers to a sandy textured khaki to buff color. Fresh rock is gray. Quartz veins up to 2" thick were noted in some boulders. The metasandstone sometimes contains clasts of graywacke or phyllite. The phyllite is well foliated.

Site Potential: The potential of this site is limited due to its location (see Development Considerations). A degradation test on this material yielded a value of 39, L.A. Abrasion loss of 24.5%, and a soundness loss of 0.5%. The degradation value is below the minimum of 45 for aggregate for base; however, it does meet the standard of 30 for aggregate for pavement.

Dimensions/Resource estimate: 250,000 short tons of loose rock. This estimate is based on a distance to the cliff face of 600 ft, a length of the exposure of 500 ft, and an estimated depth of 15 ft. A specific gravity of 2.65 was used in the calculations. This estimate should be considered approximate, since the distance to the cliff face was estimated using vertical angles and the material contains open space (i.e. it is not densely packed).

Development Considerations: The resource is limited by the thickness of the metasandstone unit, location of the power line, steep slope, rockfall danger to the Sterling Highway and power line, and visual impact if the pit is excavated into the mountain. There is an active raven nest directly above the RS&S, about 30-40 ft below the ridge.

The primary concern in development would be slope failure resulting in damage to the powerline and/or highway.

19 Resurrection Creek Bench

Location:

Township	Range	Section	Map	Latitude	Longitude
9N	2E	4	Seward D-8	N 60 53 53	W149 38 10

Commodity: Sand and gravel; gold
Status: Inactive
Description and site history:

This site is a bench on Resurrection Creek, approximately 300 ft west-southwest of the American Way Pit. A road leads down to the creek and the site of past placer mining activity. The sample was taken from the road cut.

Field investigation:

Dates: 7/30/96
Samples:

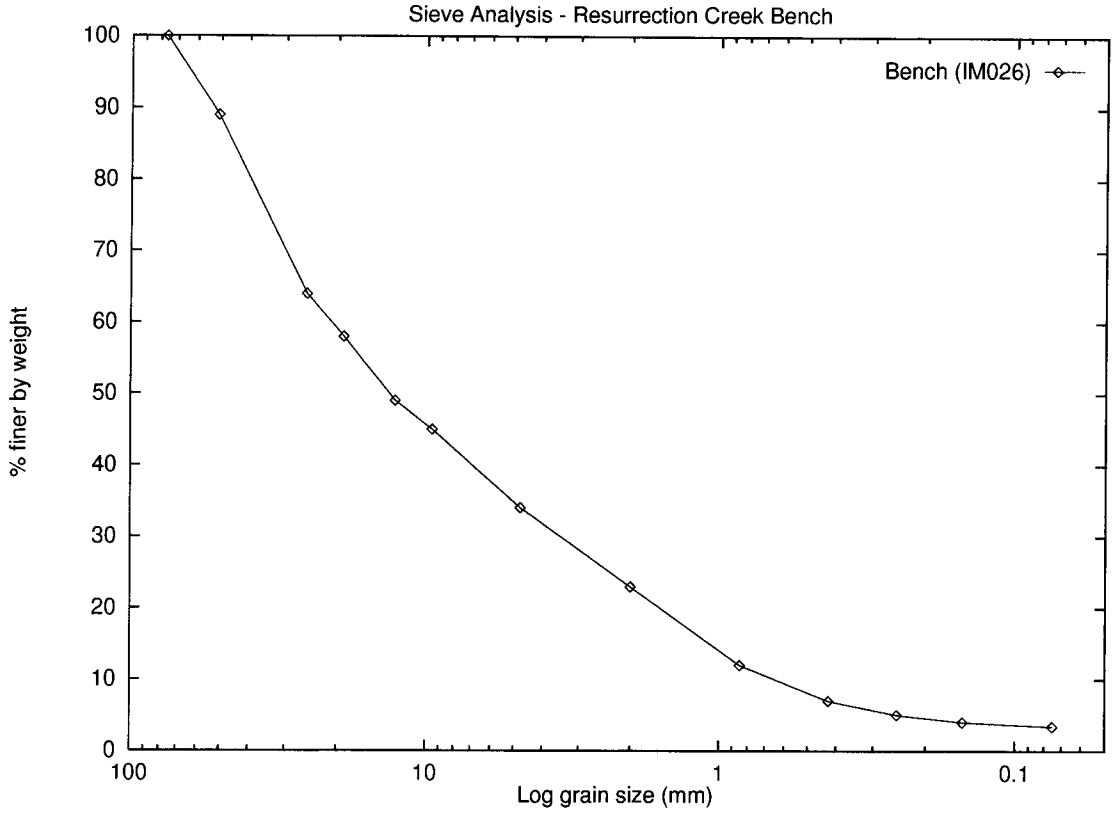
Sample numbers and descriptions - Resurrection Creek Bench

			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**-6"**	**Gravel**	**Sand**	**Silt/clay**
IM026	screened	cut bank on road to creek	173	11	66.2	30.4	3.4

Material description: The sample is fairly representative of the benches in the area; however, the thickness of the boulder layer in the section varies along the exposed cut-bank. The material is poorly sorted, moderately well rounded, with a high silt/clay content. Some silt/clay is cemented to cobbles in the sample. A silty sand layer 12 to 18 in thick is present in the section.

Sieve analysis results - Resurrection Creek Bench

Sieve size	**Diameter (mm)**	**IM026**
3	76.2	100
2	50.8	89
1	25.4	64
3/4	19	58
1/2	12.7	49
3/8	9.5	45
#4	4.75	34
#10	2	23
#20	0.85	12
#40	0.425	7
#60	0.25	5
#100	0.15	4
#200	0.075	3.4



Site Potential: This area is completely blanketed with mining claims so any mineral material leases would have to be coordinated with the mining activities of the claimants. Gold is present throughout the benches along Resurrection Creek. A pan taken from sample IM026 yielded one color of gold, approximately 1mm in size.
Dimensions/Resource estimate: None calculated
Development Considerations: N/A

20 Russian River Pit

Location: East off of the Russian River campground access road.

Township	Range	Section	Map	Latitude	Longitude
5N	4W	35	Seward B-8	N60 28 50	W149 56 08

Commodity: Sand and gravel; gold

Status: Active

Description and site history: This is a USFS pit that has been used for various purposes, including campground construction and maintenance. The pit currently has one active face in the east end. The remainder of the pit has been used to dump brush, lumber, and various other scrap. The north side has a stockpile of crushed and screened gravel, estimated to contain 1,600 cubic yards (1,200 cubic meters) of material. Oversize from a screening operation is stacked on the south side of the pit. The pit is bounded on the east and west by small drainages.

Field investigation:

Dates: 5/31/96 and 6/5/96

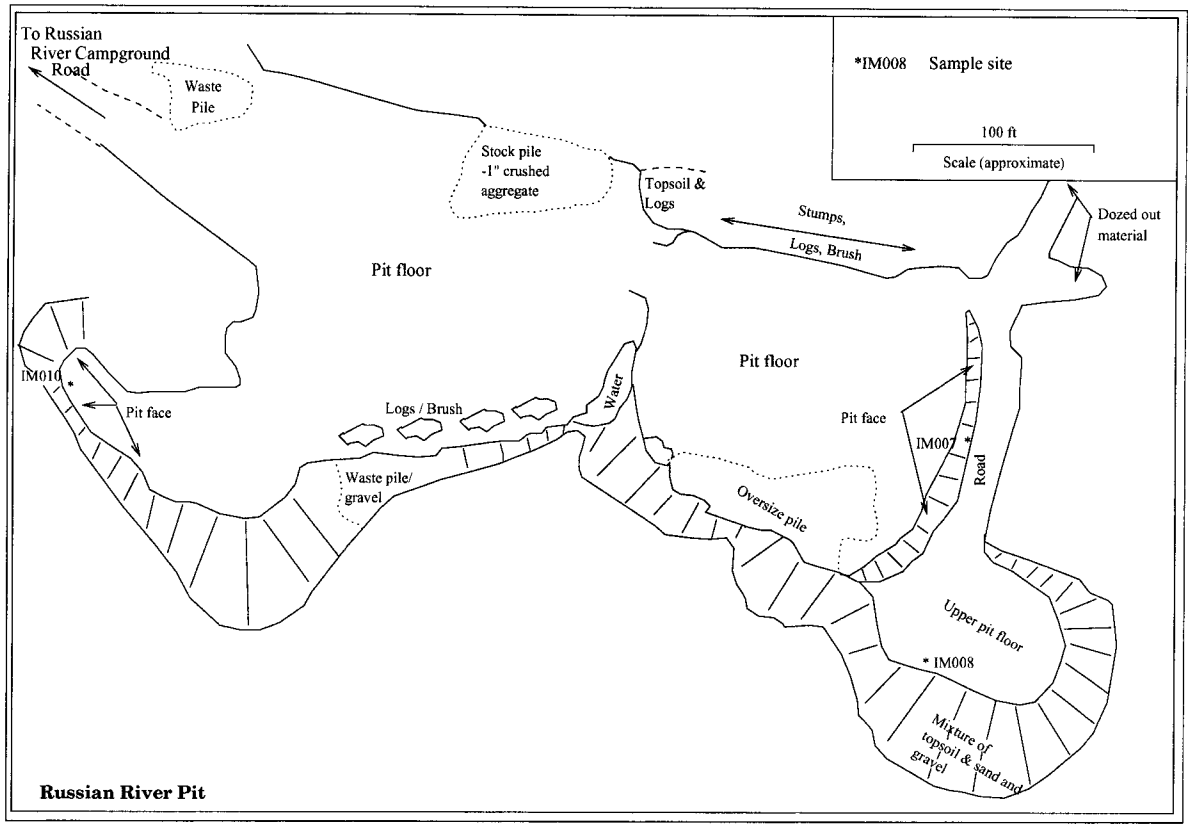
Samples:

Sample numbers and descriptions - Russian River Pit

			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM007	screened	active face - east side of pit	83	37	56.5	31.1	12.4
IM008	screened	upper bench - east end of pit	107	37	58.7	31.2	10.1
IM009	screened	bench northeast of pit	42	36	61	3.04	8.6
IM010	screened	face - west end of pit	70	96	55.5	38.4	6.1

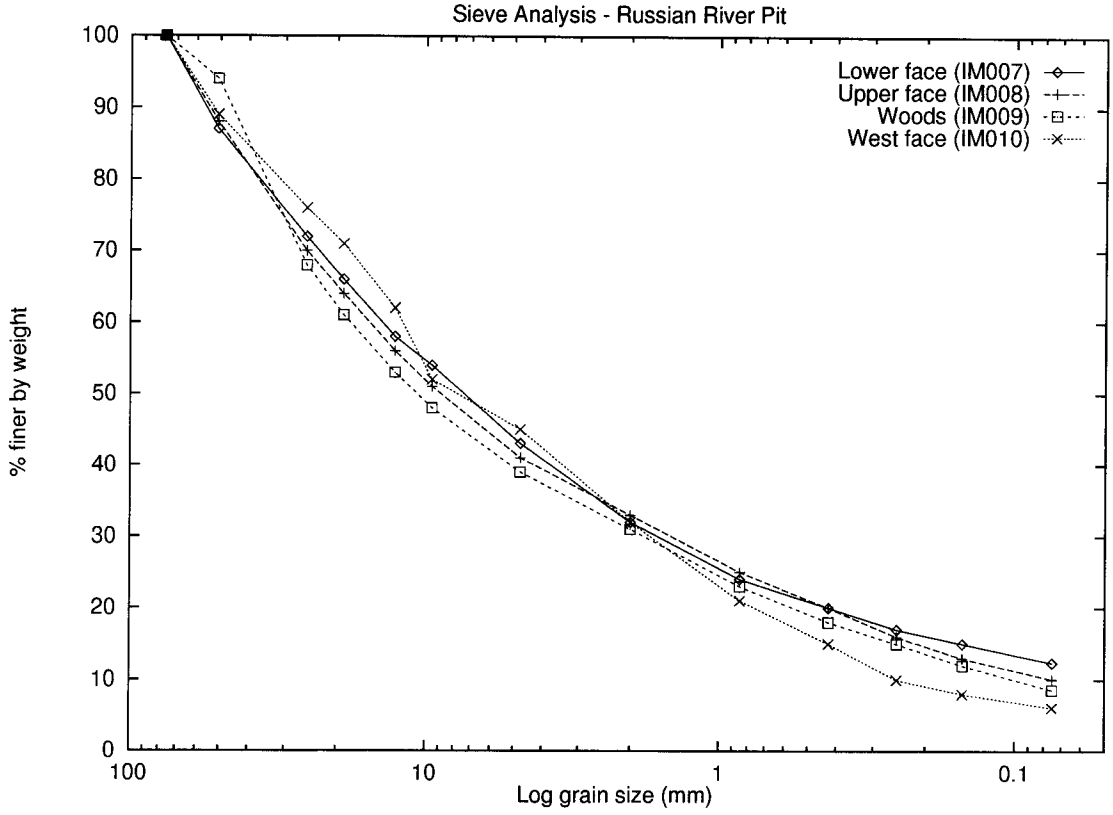
Material description: As can be seen from the sample results, the material in this pit is high in silt/clay sized particles. The material appears to be a slightly reworked glacial till, with a prevalent boulder layer near the top of the exposed section. The shape of the material varies from well rounded to subangular. Sorting is poor, with +6 in boulders occurring often throughout the section.

Sample location map - Russian River Pit



Sieve analysis results - Russian River

Sieve size	Diameter (mm)	IM007	IM008	IM009	IM010
3	76.2	100	100	100	100
2	50.8	87	88	94	89
1	25.4	72	70	68	76
3/4	19	66	64	61	71
1/2	12.7	58	56	53	62
3/8	9.5	54	51	48	52
#4	4.75	43	41	39	45
#10	2	32	33	31	32
#20	0.85	24	25	23	21
#40	0.425	20	20	18	15
#60	0.25	17	16	15	10
#100	0.15	15	13	12	8
#200	0.075	12.4	10.1	8.6	6.1



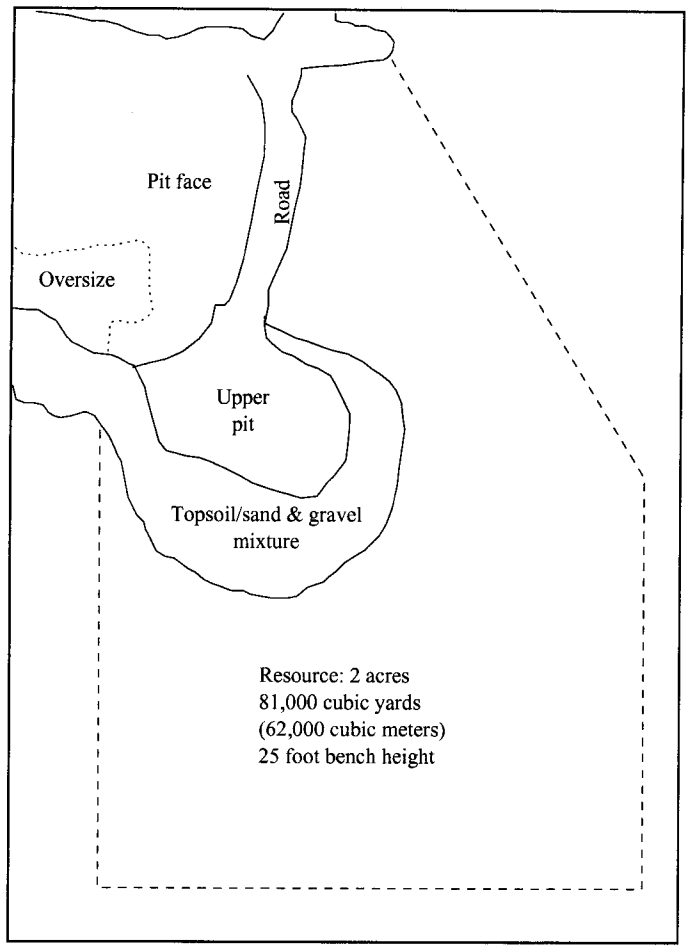
Site Potential: The current pit face can be expanded to provide additional material. The western end of the pit is essentially at its limit, due to the small drainage just beyond the pit wall. Sample IM008 was tested for degradation and soundness. The soundness value of 1.5% is easily within the requirements for crushed aggregate; however, the degradation value of 27 is below the minimums for both aggregate for base (45 minimum) and aggregate for pavement (30 minimum).

One color of gold each was found in samples IM008 and IM0010. Potential exists for placer gold in the bench gravels of the pit and to the east.

Dimensions/Resource estimate: Approximately 2 acres; 81,000 cubic yards (62,000 cubic meters); bench height of 25 ft.

This estimate is based on the pit limits imposed by the drainage to the east and the break in slope to the south. It assumes expansion of the active (east) face 150 ft to the south and 125 ft to the east. GPR results indicate bedrock as shallow as 20 ft near the active face. Depending on the slope, bedrock may be encountered in exploiting the reserves, particularly in the southwestern portion of the block.

Russian River Pit - Resource estimate



Development Considerations: Existing access is suitable for development. The main consideration is conflict with recreational use of the Russian River, since the pit is accessed via the campground road.

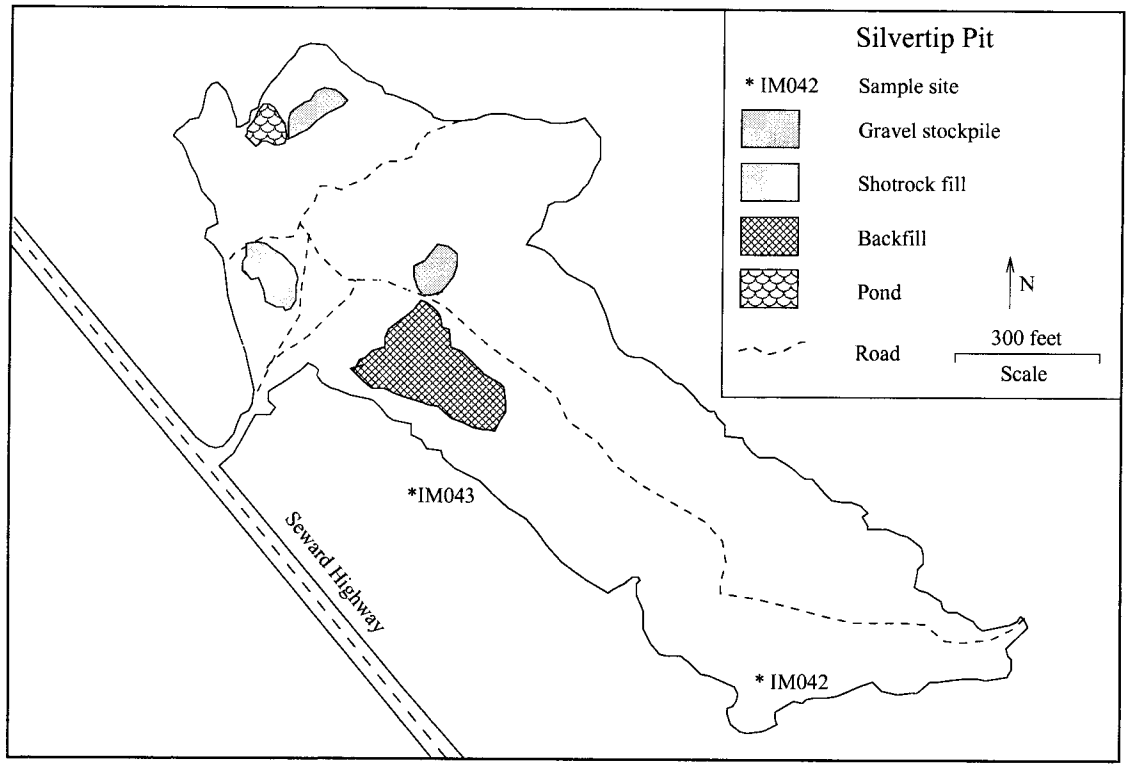
21 Silvertip Pit

Location: North side of Seward Highway, just east of Silvertip Creek

Township	Range	Section	Map	Latitude	Longitude
8N	1E	31	Seward C-7	N60 44 23	W149 21 16

Commodity: Sand and gravel
Status: Inactive
ADOT Material Site Number: 31-2-398-1
Description and site history: This site has been used extensively in the past; however, it is currently inactive. Stockpiles of screened gravel and crushed material are present within the confines of the pit. Recently the pit has been used to dump shotrock, topsoil, and stumps. There is a gate at the highway; however, at the time of the field visit there was no lock present.

Sample locations - Silvertip Pit



Field investigation:
Dates: 8/3/96
Samples:

Sample numbers and descriptions - Silvertip Pit

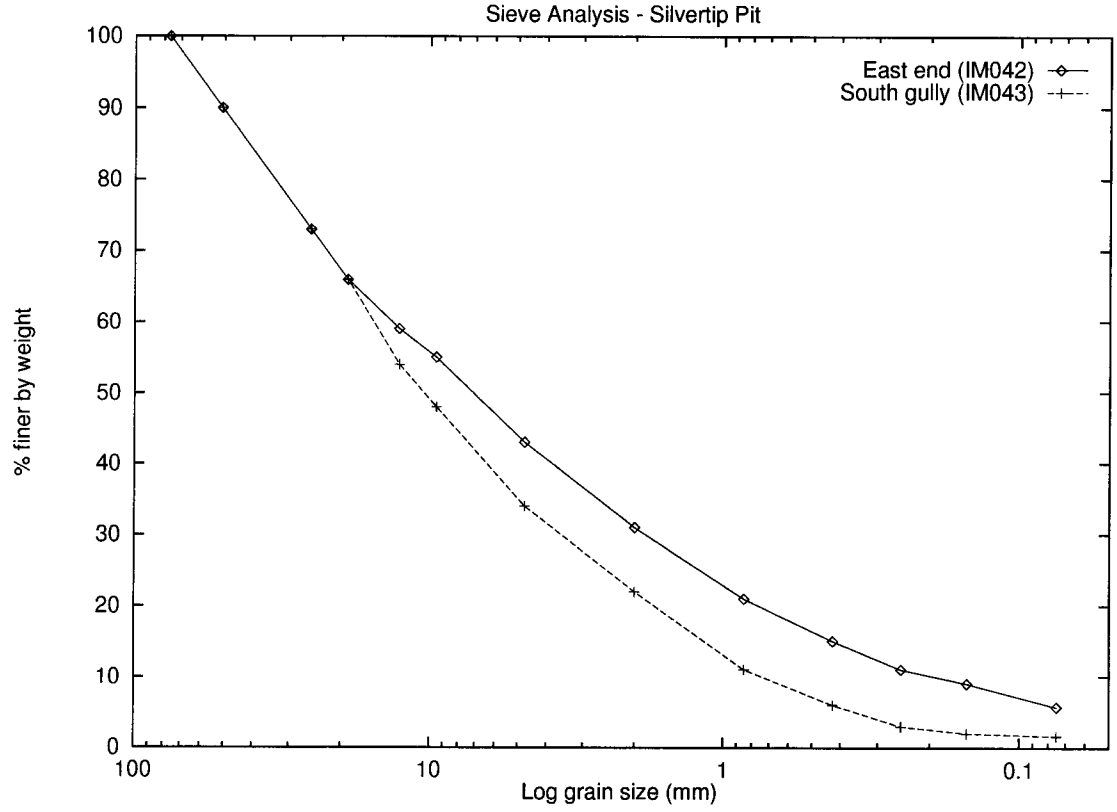
			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM042	screened	east end of pit	62	122	56.7	37.6	5.7
IM043	grab	south gully near access road	not recorded	not recorded	65.5	32.9	1.6

Material description: The material varies across the area, although it appears to transition from alluvial gravels in the western end to glacial till in the eastern end. The western portion likely was reworked at the Silvertip/East Fork confluence. Test holes dug on the bench to the east revealed glacial till with a high silt/clay size fraction. In general the material is poorly sorted (note amount of oversize fractions) and rounded

to subangular.

Sieve analysis results - Silvertip Pit

Sieve size	Diameter (mm)	IM042	IM043
3	76.2	100	100
2	50.8	90	90
1	25.4	73	73
3/4	19	66	66
1/2	12.7	59	54
3/8	9.5	55	48
#4	4.75	43	34
#10	2	31	22
#20	0.85	21	11
#40	0.425	15	6
#60	0.25	11	3
#100	0.15	9	2
#200	0.075	5.7	1.6



Site Potential: There is potential for extraction of additional material from this area; however, the amount of alluvial gravels that could be exploited is limited. The material in western portion of the pit could be screened and crushed, depending on the results of degradation tests.
Dimensions/Resource estimate: None calculated
Development Considerations: None

22 Silvertip Creek Quarry

Location: South side of Seward Highway, just west of Silvertip Creek. This is *not* the same site as the Silvertip Quarry, located on State land at Township 8N, Range 1W, Section 26.

Township	Range	Section	Map	Latitude	Longitude
8N	1W	36	Seward C-7	N60 44 45	W149 21 54

Commodity: Riprap; crushed aggregate
Status: Inactive
Description and site history: This site has been has been used as a source of riprap and shot rock. The site has two distinct areas:

1. the lower site along the Seward Highway
2. the upper site at the end of the short gravel road accessible from the southeast end of the lower site

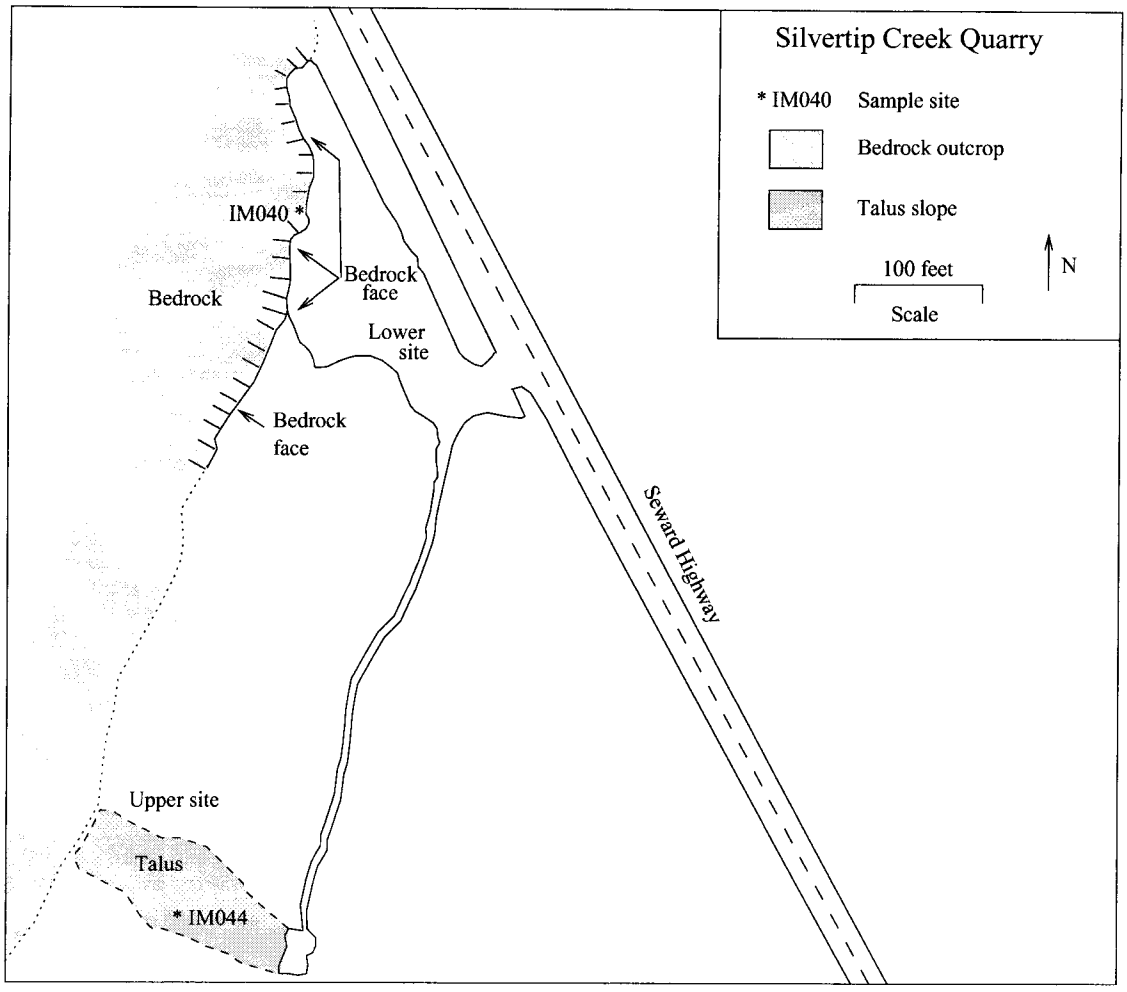
The lower site has had a significant amount of material blasted and removed. There is a 0.5-acre cleared area, much of which was created by removal of the rock face. At the upper site it appears that some gravel has been removed below the rock source, which consists of a talus slope of broken material.
Field investigation:
Dates: 8/3/96 and 8/5/96
Samples:

Sample numbers and descriptions - Silvertip Creek Quarry

Sample #	Type	Location
IM040	rock	talus below outcrop, lower site
IM044	rock	talus , upper site

Material description:
Lower site: The rock is a dark gray metasandstone with crosscutting quartz, calcite, tremolite veins. Some evidence of phyllite/schist inclusions is present in the western face. The material breaks into a wide variety of sizes, with the maximum size being 4 to 6 ft. The resource is limited to approximately 100 ft back from the face by an apparent fault trace.
Upper site: The rock consists of blocky metasandstone boulders varying in size to approximately 10 ft. The material is dark gray with quartz veins. No calcite or tremolite was noted.

Sample location map - Silvertip Creek Quarry



Site Potential: The lower site has limited potential due to its proximity to the highway. There is a significant resource present; however, blasting operations would require closure of the highway. The upper site has potential since the rock is already broken and would require only mechanical breaking to size it for loading.

Dimensions/Resource estimate: No estimate was done for the lower site. The upper site consists of a talus slope that is approximately 250 ft long and 30 to 50 ft wide. Assuming an average depth of 6 ft, this represents a resource of 100,000 cubic ft of rock. Using a specific gravity of 2.65, this is equivalent to 8,250 short tons of material. Bedrock is present at the top of the slope. This estimate should be considered a minimum, as the depth of the material could exceed 10 ft.

Development Considerations: The slope of the material on the upper site could result in hazardous conditions during extraction. Precautions would be needed to prevent rock falls and slope failure. Development of the lower site is impractical due to its proximity to the highway.

23 Silvertip Road

Location: Mine road and old Lynx Creek trail

Township	Range	Section	Map	Latitude	Longitude
7 & 8N	1E	6 & 31	Seward C-7	N60 44 30	W149 21 00

Commodity: Sand and gravel
Status: Undeveloped
Description and site history: The road leads to the Silvertip Creek placer claims to the west and parallels the East Fork drainage to the east. The portion of the road leading to the placer claims was not examined. The eastern portion of the road is actually part of the old trail from Sunrise to Lynx Creek. The road extends 0.4 miles to the east where it is cut off by erosion from East Fork Creek. This area is undeveloped and no signs of recent activity are visible.
Field investigation:

Dates: 8/8/96

Samples: None

Material description: Several small test holes were excavated, revealing sandy gravels along the creek, changing to angular material to the south.

Site Potential: This site has little potential due to the limited amount of stream gravels.
Dimensions/Resource estimate: None calculated
Development Considerations: Development in this area would likely be visible from the highway. Some evidence of old placer/prospecting activity was noted. This area may have some historical significance.

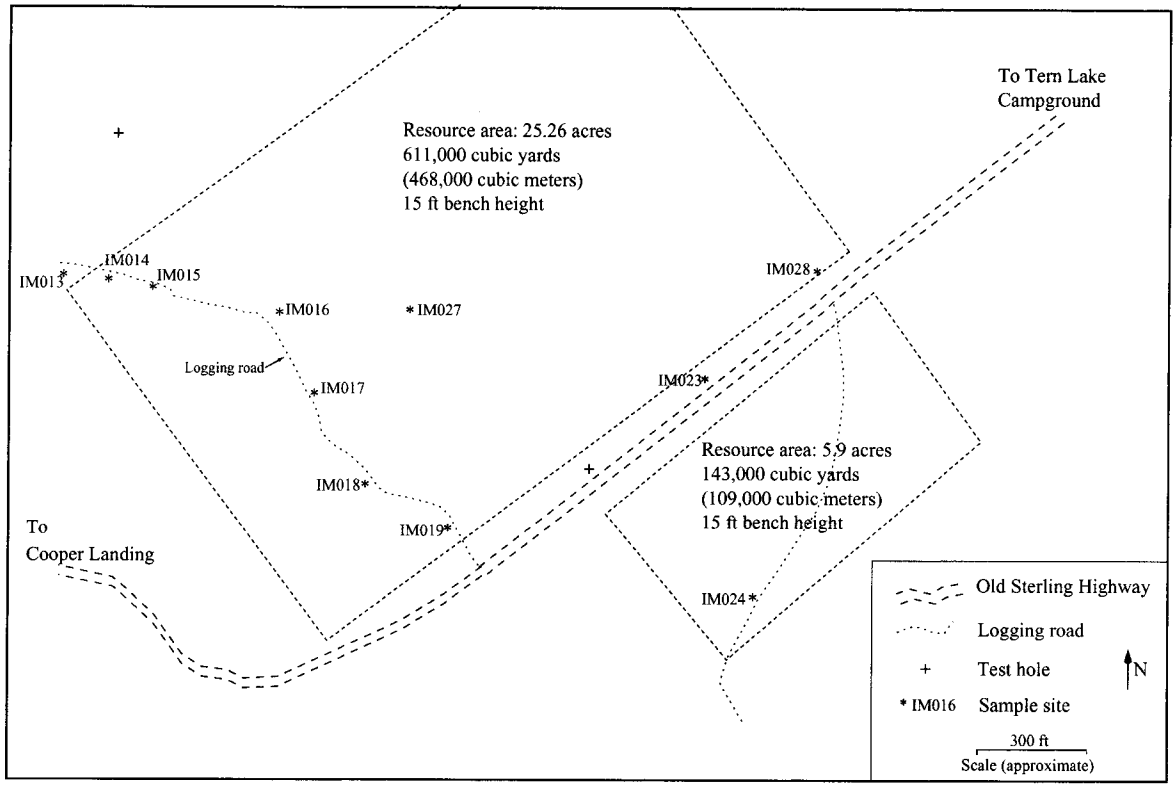
24 Tern Lake Fan

Location: Old Sterling Highway, from Tern Lake Campground Road to a timber cut on the north side of the road.

Township	Range	Section	Map	Latitude	Longitude
5N	2W	11, 13, & 14	Seward C-7	N 60 31 44	W149 33 37

Commodity: Sand and gravel; gold
Status: Undeveloped
Description and site history: This summary covers the area southwest of the campground to the point where the Old Sterling Highway makes a 90 degree turn to the northwest. This encompasses approximately 1 mile of road. The first portion of the road from the campground is heavily timbered with small spruce trees on both sides. No samples were taken along this portion. The remainder of the area has been logged on both sides of the road and shows evidence of having been burned. Some evidence of recent timber cutting was noted. The road traverses a slope that is an alluvial fan created by the small unnamed creek that flows north into Tern Lake. The expression of this fan is easily seen on a topographic map.

Sample location map - Tern Lake



Field investigation:

Dates: 6/3/96 and 7/31/96

Samples: Although the creek is relatively short (less than 3 miles), the fan was initially considered to have potential for alluvial gravels. Eleven samples were collected and several test holes were dug in the area to assess the potential for sand and gravel extraction.

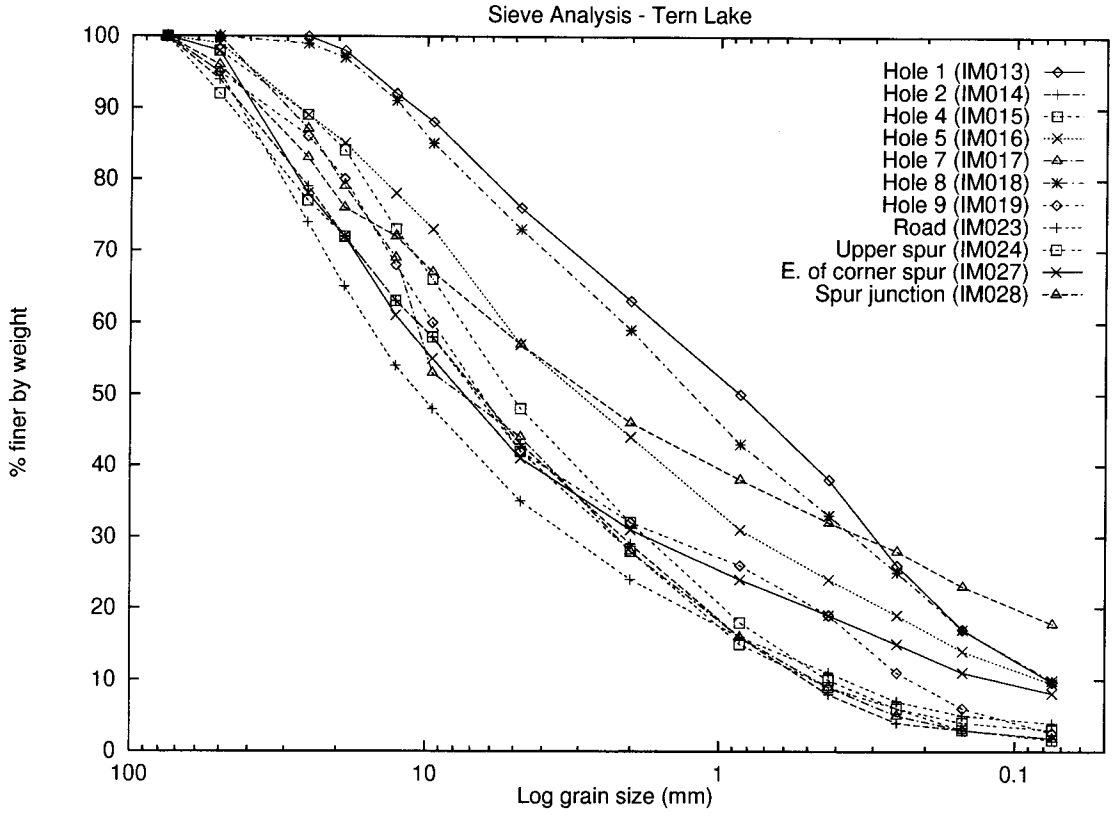
Samples numbers and descriptions for Tern Lake

			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM013	screened	test hole #1	-	-	23.6	66.7	9.7
IM014	screened	test hole #2	3	-	57.4	40.8	1.8
IM015	screened	test hole #4	6	-	52.4	46	1.6
IM016	screened	test hole #5	-	-	42.9	47.6	9.5
IM017	screened	test hole #7	-	-	56.4	41.8	1.8
IM018	grab	test hole #8	-	-	27.4	62.7	9.9
IM019	screened	test hole #9	5	-	58.2	39.2	2.6
IM023	screened	0.1 miles east of lower spur	31	8	65	31.1	3.9
IM024	screened	upper spur road	32	-	57.9	39.1	3
IM027	screened	200 ft east of IM016	43	24	59.3	32.6	8.1
IM028	screened	intersection with upper spur	27	-	43.4	38.8	17.8

Material description: The material is generally described as a well graded gravel with sand. This varies across the fan, with material at the fringes often consisting of poorly graded sandy or silty gravel. The coarser material is found in what was the high energy environment of the alluvial fan. The samples generally grade from coarser material upslope to finer, more silty material down slope. The shape of the material varies from subangular to well rounded. Avalanche debris is present in the upper portions of the fan and has covered the alluvial material. The depth of the debris is unknown.

Sieve analysis results - Tern Lake Fan

Sieve	Diameter	IM013	IM014	IM015	IM016	IM017	IM018	IM019	IM023	IM024	IM027	IM028
3	76.2	100	100	100	100	100	100	100	100	100	100	100
2	50.8	100	94	98	99	100	100	95	95	92	98	96
1	25.4	100	79	89	89	87	99	86	74	77	78	83
3/4	19	98	72	84	85	79	97	80	65	72	72	78
1/2	12.7	92	63	73	78	69	91	68	54	63	61	72
3/8	9.5	88	58	66	73	53	85	60	48	58	55	67
#4	4.75	76	43	48	57	44	73	42	35	42	41	57
#10	2	63	29	32	44	28	59	32	24	28	31	46
#20	0.85	50	16	18	31	16	43	26	16	15	24	38
#40	0.425	38	8	10	24	9	33	19	11	9	19	32
#60	0.25	26	4	6	19	5	25	11	7	6	15	28
#100	0.15	17	3	3	14	3	17	6	5	4	11	23
#200	0.075	9.7	1.8	1.6	9.5	1.8	9.9	2.6	3.9	3	8.1	17.8



Site Potential: This site has potential for borrow material and sand. Pit run material can be used as borrow while the lower portion of the site with high sand content could be screened to produce sand. Further excavation is required to determine the true nature of the site.

Dimensions/Resource estimate: 31 acres, 754,000 cubic yards (577,000 cubic meters). This resource is composed of two separate areas:

1. Northwest of the road: 25.26 acres containing 611,000 cubic yards (468,000 cubic meters) of material
2. Southeast of the road: 5.9 acres containing 143,000 cubic yards (109,000 cubic meters) of material

Both areas assume a bench height of 15 ft. The northwest area contains both sand and gravel with sand. The limits are based on the sampling effort and topography. The southeast area contains gravel with sand and generally is comprised of coarser material. These estimates should be considered minimums.

One color of gold was found in a 1 pan sample taken from the remaining split of IM023. Presence of gold in such a small sample indicates that further potential exists in the alluvial fan.

Development Considerations: This site could be readily developed as most of the trees have been cut and there is suitable access to the site. To minimize impact on the campground/day-use area, a road from the highway across Daves Creek could be constructed to provide access. This would minimize impact to recreation and provide a single use access point to the resource. Pit security would be a consideration since access to the site could be gained from both ends of the Old Sterling Highway.

25 West Juneau Creek Pit

Location: Timber harvest road; west of the southern trailhead of Resurrection Pass trail

Township	Range	Section	Map	Latitude	Longitude
5N	4W	27	Seward B-8	N60 29 02	W149 57 10

Commodity: Sand and gravel
Status: Inactive - small amount of material excavated
Description and site history: This site is the first pit encountered on the West Juneau Creek road in the southwest corner of the USFS land reserved for the Resurrection Pass Trail. It has been shallowly excavated and the terrain consists of a gently sloping terrace. Excavation depths are less than 6 ft. No active extraction is currently taking place.
Field investigation:
Dates: 5/29/96
Samples: A 750 lb sample was screened and a 70 lb split was retained for sieving.

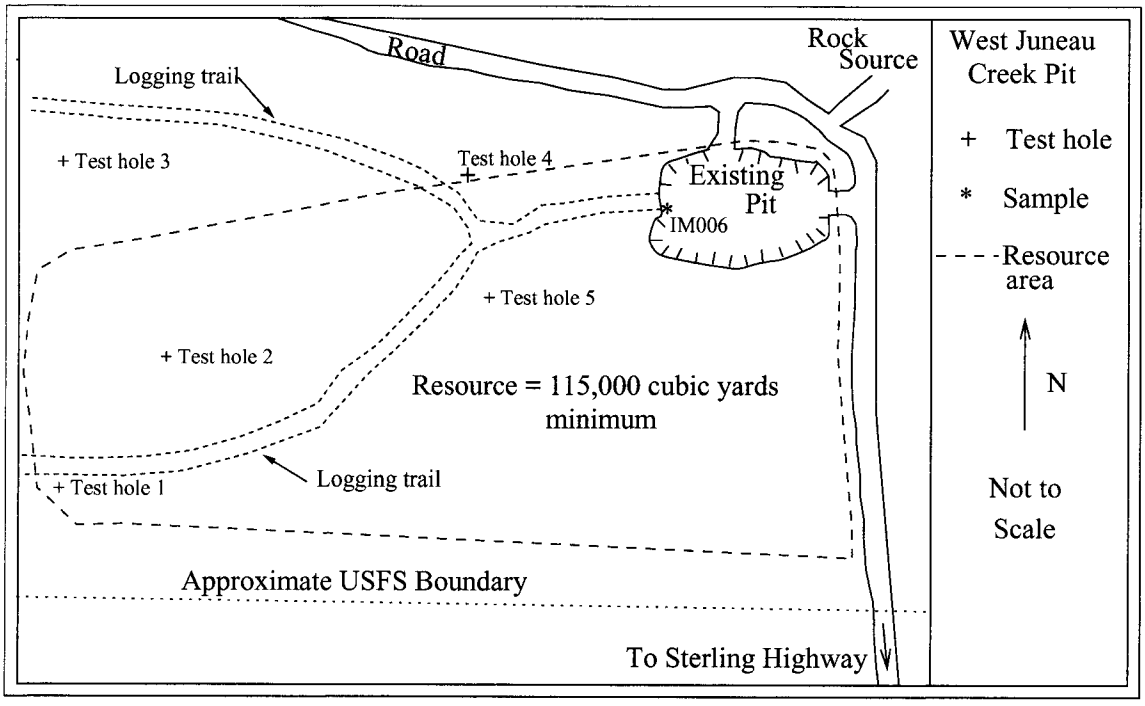
Sample numbers and descriptions - West Juneau Creek Pit

			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM006	screened	first pit	1	-	33	63.1	3.9

Material description: The material is a sandy alluvial gravel, well sorted with 99% passing 3". One 1 lb cobble was retained on the screens. The character of the material at depth is unknown due to limited cross section. The sample hole was 36 x 18 x 16 in deep and was excavated in a small cut bank at the west end of the pit.

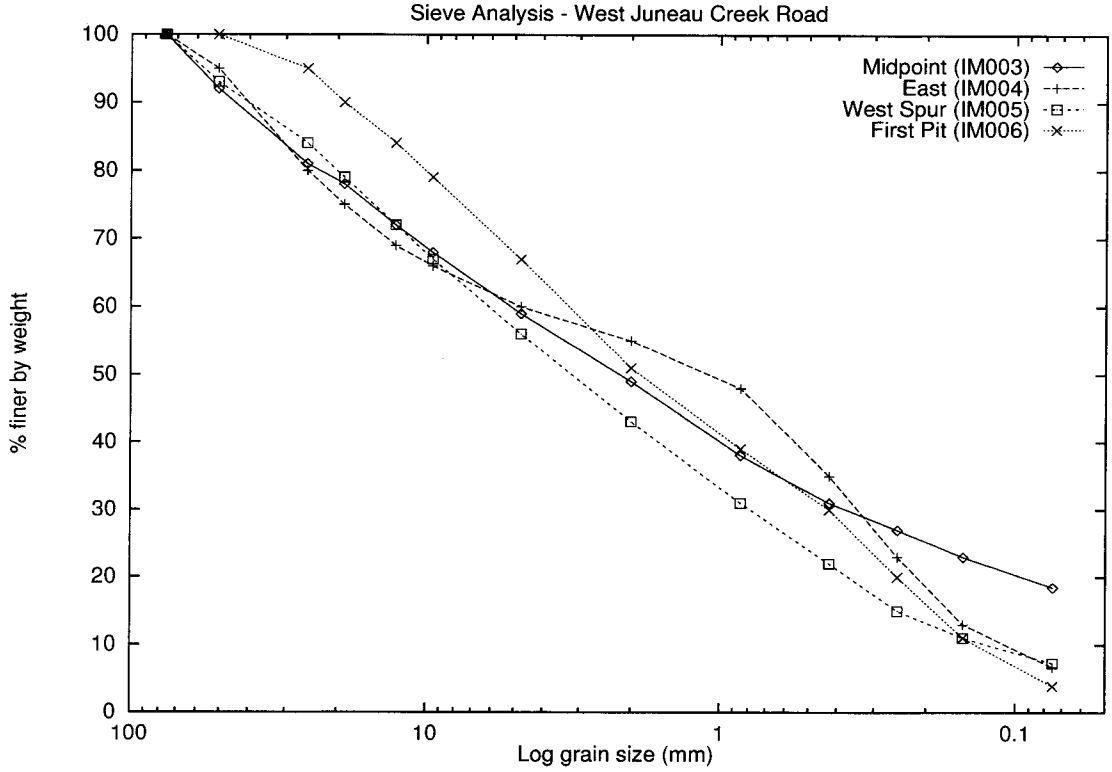
Five test holes were dug on the gently sloping terrace west of sample IM006. These holes were used to inspect the gravels and compare them with IM006 to determine a potential reserve. The test holes revealed glacial deposits of silt, clay, and some cobbles to the north, with alluvial gravels to the south.

Sample location map - West Juneau Creek Pit



Sieve analysis results - West Juneau Creek Pit

Sieve size	Diameter (mm)	IM006
3	76.2	100
2	50.8	100
1	25.4	95
3/4	19	90
1/2	12.7	84
3/8	9.5	79
#4	4.75	67
#10	2	51
#20	0.85	39
#40	0.425	30
#60	0.25	20
#100	0.15	11
#200	0.075	3.9



Site Potential: Moderate potential for borrow material. Character of the material at depth is unknown. Due to the size fraction, this material is unsuitable for crushed aggregate.

Dimensions/Resource estimate: Approximately 9 acres with a minimum of 115,000 cubic yards (88,000 cubic meters) of borrow material. This estimate is based on the area of the terrace on USFS land containing alluvial gravels and assumes a pit depth of 8 ft. The potential pit area is 300 ft by 1,300 ft. A depth of 8 ft was selected because it is likely to be above the water table. The water table depth at this site is unknown; however, GPR results indicate that is may be as deep as 25 ft. If extraction to 15 ft without encountering water is possible, the resource increases to 217,000 cubic yards (167,000 cubic meters).

Development Considerations: The area of the resource has been previously logged off, minimizing the amount of clearing required prior to extraction of gravel. This site is approximately 1/4 mile from the Resurrection Pass trail; however, gravel extraction via loader should not have any greater impact than road

noise from the Sterling Highway. The road from the highway to the pit area is in good condition and would provide a downhill haul from the pit site.

26 West Juneau Creek Road

Location: Timber harvest road; west of the southern trailhead of Resurrection Pass trail

Township	Range	Section	Map	Latitude	Longitude
5N	4W	25-27	Seward B-8	N60 29 02	W149 57 10

Commodity: Sand and gravel
Status: Some borrow pits from road construction
Description and site history:

The West Juneau Creek Road is approximately 5.2 miles long, with several spurs (side roads) comprising an additional 2 miles. The road was constructed for the purposes of timber extraction and is in varying states of repair. Much of the road, especially the spurs, is single lane. No gravel extraction has occurred, except for several small borrow sites that were used in the construction of the road.

Field investigation:

Dates: 5/29/96

Samples: A total of 4 samples were taken from various locations along the road. This includes sample IM006 from the West Juneau Creek pit. Test holes were dug in several locations along the road to characterize the gravels.

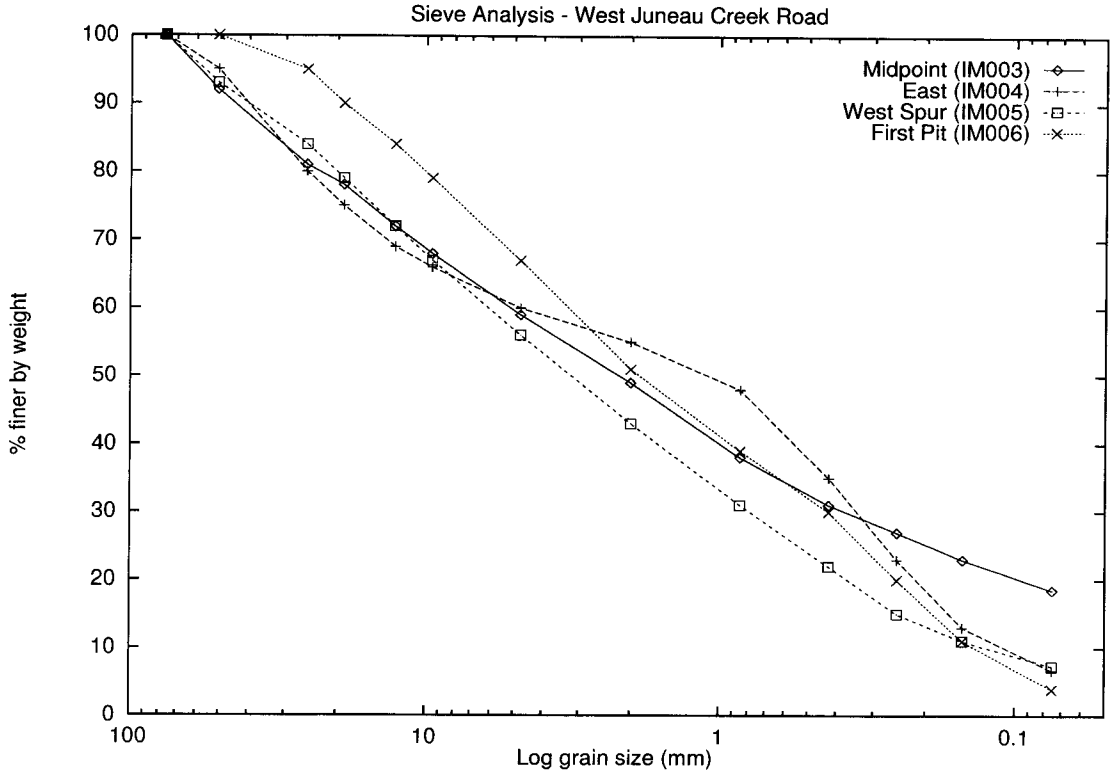
Sample numbers and descriptions - West Juneau Creek Road

			Oversize (lbs)		%		
Sample #	**Type**	**Location**	**+3 to -6"**	**+6"**	**Gravel**	**Sand**	**Silt/clay**
IM003	screened	road cut on bench	89	15	33	63.1	3.9
IM004	screened	road cut near east end of road	45	56	39.5	53.8	6.7
IM005	screened	west spur road	-	-	44	48.7	7.3
IM006	screened	first pit	1	-	33	63.1	3.9

Material description: The majority of the material along the road appears to be glacial till. This is indicated by the poorly sorted nature of the gravels, as well as the high silt/clay sized fraction content and poor rounding. An exception is the material at the West Juneau Creek pit (see previous summary). The size analysis of the samples indicates that they are poorly suited for crushed aggregate. The greater majority (80%+) passes 1 in.

Sieve analysis results - West Juneau Creek Road

Sieve size	Diameter (mm)	IM003	IM004	IM005	IM006
3	76.2	100	100	100	100
2	50.8	92	95	93	100
1	25.4	81	80	84	95
3/4	19	78	75	79	90
1/2	12.7	72	69	72	84
3/8	9.5	68	66	67	79
#4	4.75	59	60	56	67
#10	2	49	55	43	51
#20	0.85	38	48	31	39
#40	0.425	31	35	22	30
#60	0.25	27	23	15	20
#100	0.15	23	13	11	11
#200	0.075	18.5	6.7	7.3	3.9



Site Potential: Material along the entire road may be suitable for borrow, providing the high silt content (18% in sample IM003) is not critical in the application. Sample IM004 met the requirements for use as aggregate for asphalt (see Appendix B).

Dimensions/Resource estimate: None calculated

Development Considerations: Portions of the West Juneau Creek road will be near the proposed Cooper Landing Bypass highway project. Although the majority of the bypass is sited on State owned or selected lands, there may be a need for materials from USFS lands. Should this need arise, additional investigation of sites within reasonable distance of the project would be warranted.

27 West Juneau Creek Road Rock Source

Location: West Juneau Creek road, across from small gravel pit

Township	Range	Section		Map	Latitude	Longitude
5N	4w	27		Seward B-8	N60 29 27	W149 56 57

Commodity: Rip-rap; crushed aggregate; decorative rock
Status: Undeveloped
Description and site history:

This site appears to have had limited use as a rock source. Some of the rock in the talus slope has been removed, possibly during construction of the timber road.

Field investigation:

Dates: 5/30/96 and 8/8/96

Samples:

Sample numbers and descriptions - West Juneau Creek Road Rock Source

Sample #	Type	Location
IM060	rock	talus below rock outcrop

Material description: The rock is a hard metasandstone with some interbedded phyllite. Some of the metasandstone contains phyllite fragments in common alignment. No phyllite was seen in outcrop above the talus slope. The material breaks into angular fragments ranging from -3 in to +3 ft in size. Roughly 80% of the rock is +6 in to -16 in. The rock breaks into elongated blocks and is buff to light gray in color. Some quartz veins up to 1 in wide are present.

Site Potential: High potential for crushed rock source and possibly riprap. The rock could also be used as a community source for building stone or decorative rock. The appearance of the rock is not exceptional; however, it can be used in landscaping applications.

Dimensions/Resource estimate: 446 lineal feet of talus; 21,000 short ton (19,000 metric tons) loose rock.

The resource estimate was determined based on slope distance and inclination measurements. The talus slope represents a material source that can be used with no significant excavation other than loading. Some material has already been removed from both ends of the slope. Talus extends along the bedrock "cliff" for 446 ft from the road. A much greater resource is present if the bedrock is exploited. The summit of the bedrock knob was estimated to be 190 ft above the base of the talus slope.

Development Considerations:

Extraction of rock from the bedrock will require drilling and blasting. This site is approximately 1/4 mile from the Resurrection Pass Trail so any operations would have to consider potential impact to trail users. Mechanical impact breakers could be used in place of explosives for portions of operation.

Appendix - B

Quality Test Results

The following table lists the results of quality tests on selected samples from the study. The cost of conducting these tests is high, therefore representative samples from the sites were selected for analysis.

The sites shown in boldface are those that meet the degradation criteria of 30 minimum for asphalt; the italicized sites are those that met the criteria of 45 minimum for base course. Note that the degradation value is the deciding factor, since all the samples were below the cutoffs[6] for L.A abrasion (45 for asphalt, 50 for base) and Sulfate Soundness (9 max. for asphalt).

Site	Sample #	L.A. Abrasion (T-96)	Degradation (T-13)	Soundness (T-104)
Bear Pit - West	IM046	38	19	-
Bear Pit - Access Road	IM048	33	20	-
Canyon Creek Lower	IM061	20	26	-
Canyon Creek Midway	**IM063**	**21**	**35**	**-**
Canyon Creek North	IM064	22	27	-
Canyon Creek Lower Spur	IM066	21	23	-
East Fork Exploration Pit	IM029	33	28	-
East Fork Woods	IM030	34	12	-
Fly Pit East Cut Bank	IM035	35	24	-
Fly Pit - East Logging Road	IM058	36	18	-
Mile 35 Pit	IM002	23	21	1.5
Mile 35 Pit - Revegetated	IM022	24	22	-
North Granite Creek Road	**IM041**	**21**	**37**	**0.5**
Quartz Creek Road	IM011	19	22	0.8
Quartz Creek Floodplain	**IM068**	**19**	**38**	**-**
Resurrection Creek Bench	IM026	20	13	-
RS&S	**IM025**	**24.5**	**39**	**0.6**
Russian River Pit Face	**IM007**	**20**	**33**	**-**
Russian River Pit Upper	IM008	-	27	1.5
Russian River NE	IM009	24	14	-
Russian River Pit West	IM010	21	17	-
Silvertip Pit - East	**IM042**	**25**	**30**	**-**
Silvertip Pit - South Gully	IM043	23	18	-
Silvertip Quarry	***IM040***	***18***	***71***	***1.5***
Silvertip Quarry - Talus	***IM044***	***22***	***51***	***0.9***
Tern Lake Fan	IM027	25	19	-
Tern Lake Fan - Lower	IM014	23	13	-
Tern Lake Fan - Road	IM023	23	11	-
West Juneau Creek Road Rock Source	***IM060***	***20***	***51***	***0.8***
West Juneau Creek Road	**IM004**	**15**	**40**	**0.3**

[6]Based on DOT requirements from *Standard Specifications for Highway Construction*, 1988, pp. 521-522.